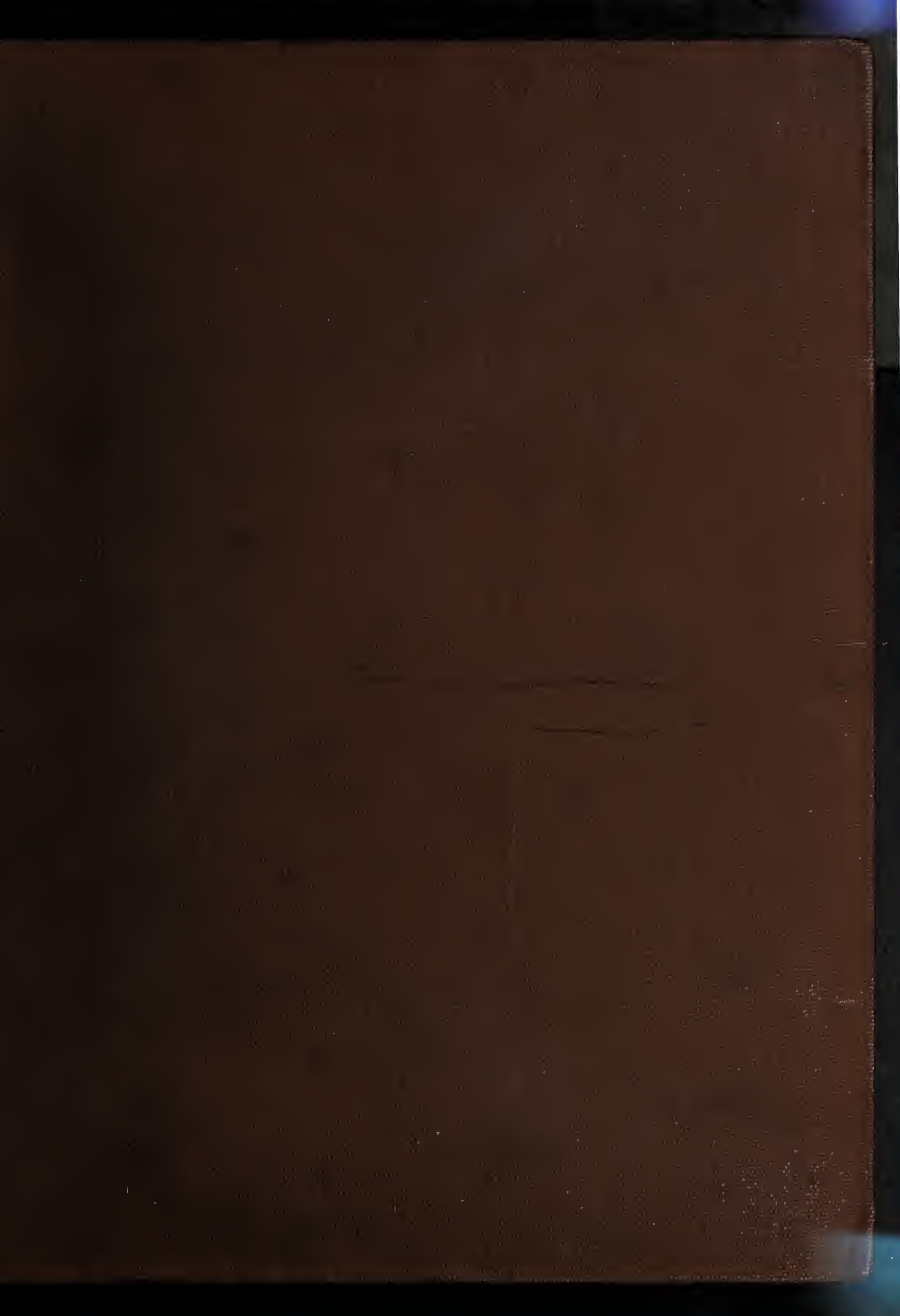




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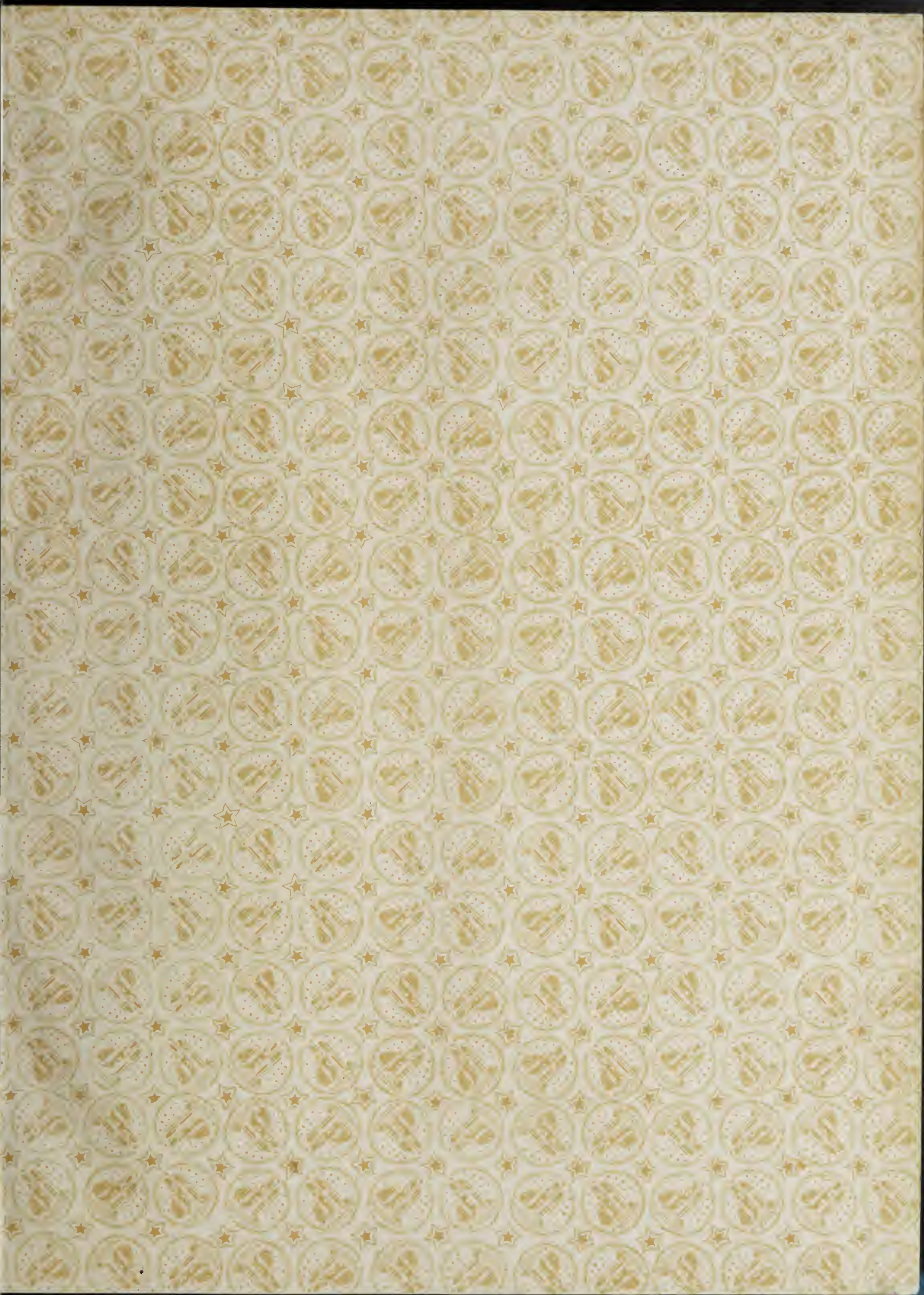
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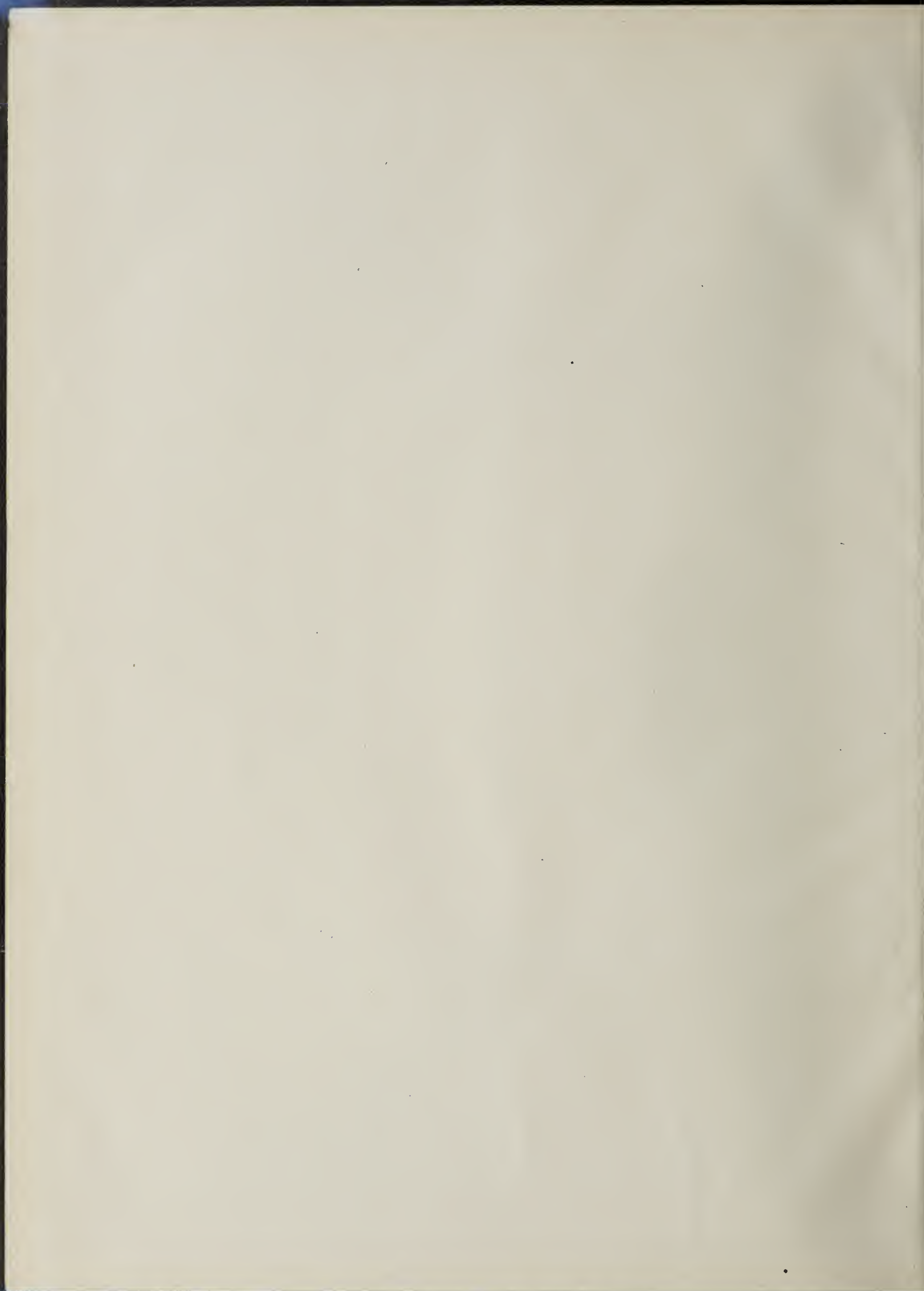
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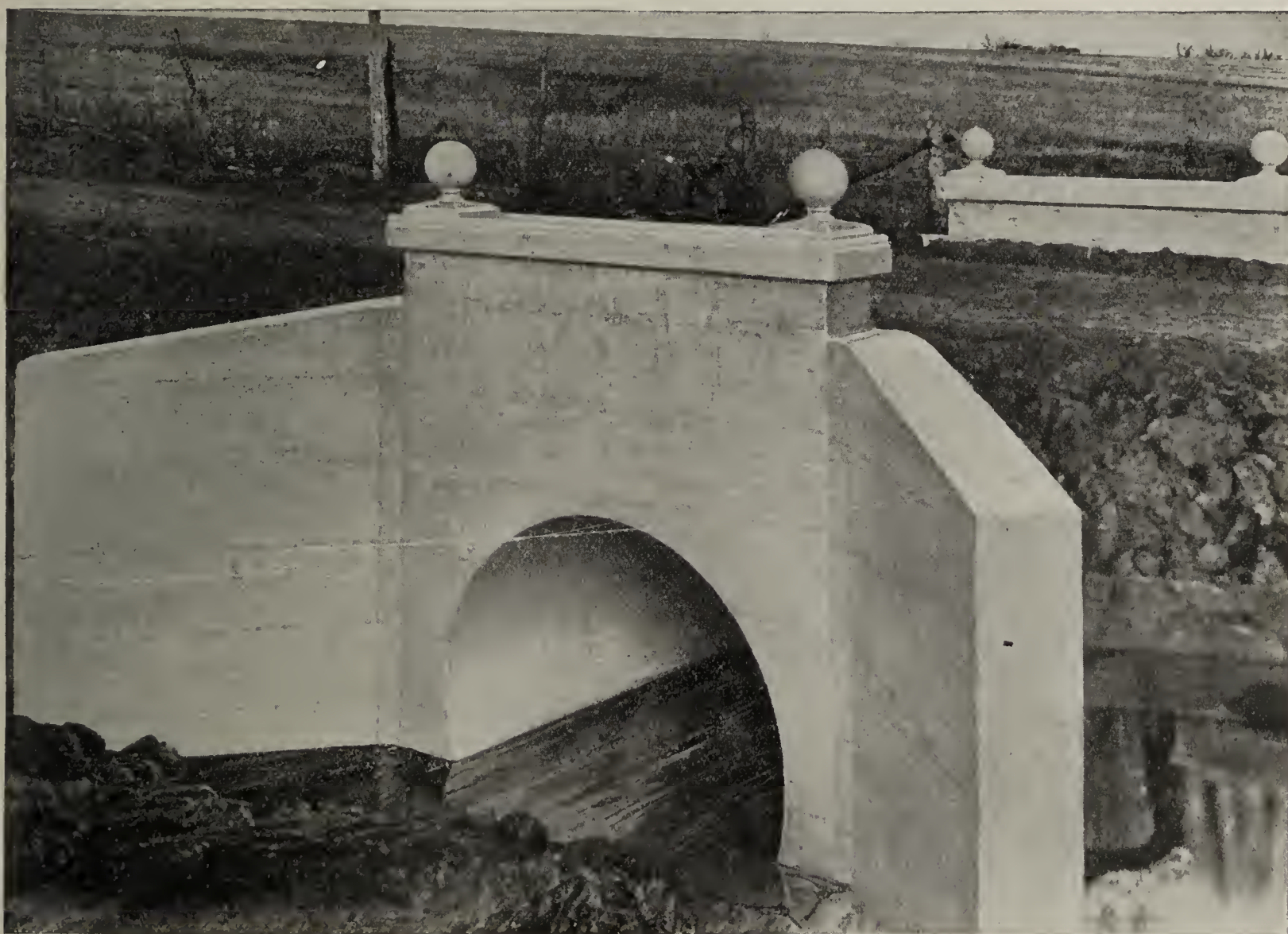
CEMENT

... AND ...

ENGINEERING NEWS

REMOTE STORAGE

Reinforced Concrete Culverts



CIRCULAR CULVERT, DIAMETER 6 FEET. LIBERTY TOWNSHIP, GRUNDY COUNTY, MISSOURI.
REINFORCED WITH "ECONO" EXPANDED METAL.



Make A Memorandum To Go To The Cement Show

in Chicago February next. A visit to the Cement Show need not require much time—and the exhibition comes but once during the year. The biggest, most reliable manufacturers in the country are represented—manufacturers of established prestige who have faith in their products and are glad to submit them for critical comparative study. They go to great expense to make it easy for you to buy with discrimination and discernment.

The Coliseum will be a gigantic showcase for the concrete industries and, with the many incidental conventions, a forum for free and stimulating discussion. Look ahead to the

Seventh Chicago **Cement Show**

February 12-21, 1914

Annual Convention American Concrete Institute
Chicago, February 16-20, 1914

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year, or two
years for \$1.50. All other countries, \$1.50 per year

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JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, JANUARY, 1914

PROSPERITY AHEAD

The year 1913 has proven another one of progress for the cement industry in the United States. The constantly increasing demand has raised the consumption far above that of previous years, with consequent stability to the cement market. The industry at large is in a healthy, prosperous condition.

A new era of business prosperity is at hand. Factories that have been closed are preparing to reopen. Factories that have been operating on reduced time or with a depleted force of employees are preparing to operate at capacity again. From all directions the report is that the number of idle men is small and decreasing.

This year, more than ever before, cement will be used especially for road construction, as the movement in favor of good roads has led to the adoption of a number of important highways from ocean to ocean in addition to innumerable roads to be built by every state in the union. All railroads are large consumers of cement. Cities, in their improvement work, consume vast quantities of cement. Every type of pavement is now laid on a concrete base. Hence the prospects for still larger consumption during 1914 are very bright.

THE CEMENT SHOW

If a material of construction is practical and efficient in use, flexible enough to have broad application and not prohibitive in cost it will generally have a steadily increasing use. But when honest publicity of broad scope is added to these merits, the growth may be very

great. The Seventh Chicago Cement Show, to be held February 12-21, 1914, in Chicago, will give the same honest publicity to concrete and concrete materials that nine previous Cement Shows have so effectively given. The fact that a large percentage of modern building construction is of concrete is due in no small measure to this publicity. The intrinsic merit of concrete, and its cost in comparison with equally permanent materials, are not in themselves spectacular nor self advertising. Years of development would have been required to bring the concrete industry to its present status without full publicity. The remarkable growth in the last decade is wholly normal, and the result of merit,—widely advertised.

But while the Cement Shows were once planned only to acquaint the public with the merit of concrete the present show is also a market place where the centralization of all prominent manufacturers under one roof offers full opportunity for selection.

Both these fundamental aims are necessary and no other agency equals the show's efficiency, as a means of general publicity and as a centralized market. This is recognized by leading manufacturers. Every space in the Coliseum is now contracted for, three months in advance of the show.

CEMENT DRAIN TILE

William Passage, a cement drain tile manufacturer of Bailey, Mich., writes us as follows:

I started to manufacture cement tile in December, 1909, and have heard so many complaints in regard to them not being a permanent article that I excavated some to satisfy my own curiosity.

I sold some tile to a neighbor in the spring of 1910. They were laid in muck with a blue clay bottom, where water had stood the year round—winter and summer—never dry. A 4-inch tile drained the ground perfectly so it is the very best land he has.

But the tile seem to be decaying on the bottom side; they appear as though the cement had all vanished and nothing but sand left.

These tile were a 5 to 1 mixture, made with a Farmers' Cement Tile machine, packed from the inside, a felt casing on the outside that is left on until the tile gets the initial set. But these tile were not over six days old when layed. They were sprinkled three times a day and were laid in water and covered with muck as soon as laid, so I think they should have been properly cured.

Can you tell me of any possible remedy or device that will warrant an article that will be a permanent and lasting product?

I know by experience that one three-inch cement tile will drain more ground than two six-inch clay tile will and I don't like to discontinue making them if I can make them so I can recommend them.

THE CEMENT SHOW

The concrete field is an ever-changing one. Each year is marked by important advances in the art of concrete design and construction. The contractor, the engineer, the architect, the dealer and the builder must be intensely on the alert to remain familiar with the rapidly developing industry.

The Cement Show is both a market place and a schoolroom in which are displayed modern equipment, materials and methods of concrete construction. The knowledge gained from a visit to the show, the invaluable hints and suggestions that come from viewing a comprehensive aggregation of displays, by meeting face to face men in kindred lines of work—all amply reward the visitor whether professional builder or layman.

Autoclave Test Discussed

High Pressure Steam Test for Portland Cement Officially Declared of Uncertain Value

Within the past year the so-called "autoclave" or high-pressure steam test for Portland cement, as specified for construction work on the Delaware, Lackawanna & Western Railroad, has received considerable attention from engineers, cement manufacturers, and various technical and scientific bodies.

An important discussion of the latest phases of the subject was occasioned by a paper read before the American Society for Testing Materials, at its meeting in Atlantic City, N. J., June 24-28, 1913, by H. J. Force, chemist, of the D. L. & W. Railroad, outlining the latest results obtained by the autoclave test in the laboratories of the road.

Mr. Rudolph J. Wig, of the U. S. Bureau of Standards, basing his criticism on tests made by the Bureau over a period of nine months, drew the following conclusions:

1. Of the 48 brands tested, 88 per cent passed the autoclave requirement upon some tests; 52 per cent passed upon all tests; and 6 brands failed upon all tests.
2. There is no difference in linear expansion between set cements of types 2 and 3 (unsound and sound, respectively, under autoclave test) which are exposed in the atmosphere for 6 months.
3. Nor is there any difference in linear expansion in these cements when exposed to fresh water for 6 months.
4. The linear expansion of different cements varies from 0.135 to 4.2 per cent of the original length when exposed to steam at pressures between 180 and 300 lbs. per square inch. The type 3 cements had an expansion below 0.2 per cent, and the Type 2 cements had an expansion above 2 per cent.
5. The linear expansion of set cements exposed to steam increased slightly as the steam pressure was increased. (Samples tested show an average increase of 0.02 of 1 per cent for pressures ranging from 100 to 275 lbs. per square inch.)
6. Set cements shows very little change in volume upon storage in air or water being subjected to high-pressure steam.
7. Samples of apparently sound cements and concretes have been taken from structures 1 year or more old, and found to disintegrate upon being subjected to high-pressure steam. Samples of concrete of poor quality have been taken from structures 1 year or more old, and found to show no physical change upon being subjected to high-pressure steam, while other samples of concrete of apparent poor quality entirely disintegrated.
8. The expansion of a 1:1 or 1:2 cement sand mortar made with Type 2 cement exposed to high-pressure steam, shows more than 50 per cent of the expansion of the same cement neat exposed to high-pressure steam.
9. Of cements which are normally unsound in the ordinary atmospheric steam or autoclave steam test, if the finer size particles are removed, they will be found more sound if tested in the same manner as the original cement, and in many cases entirely sound. While fineness is not essential to soundness, it is the coarser particles of a normally unsound cement which cause the expansive action.
10. A cement originally unsound in the autoclave test will usually become sound in 2 to 6 months.
11. If the cement is hydrated and formed into a test piece while it is unsound, it will not become sound

upon aging for several months, even though the test piece is stored in water.

12. The maximum tensile strength of sound cement exposed to steam appears to be attained at a pressure not exceeding 150 lbs. per square inch.

13. The compressive strength of concretes made from the three types of cement—No. 1 cement failing to pass the standard atmospheric steam test; No. 2 cement passing the standard steam test, but not passing the autoclave test; No. 3 cement passing both the standard steam test and the autoclave test—show a tendency for Type 1 cements to develop the least strength and Type 3 cements the greatest strength although the range of values is not very great, and these results should be considered somewhat tentative.

Sufficient data have not been advanced to justify a conclusion as to the merits of the proposed autoclave test of cement, or to warrant its adoption into a specification; but further investigation should be made and due consideration given to a hot test of greater severity than the present standard steam test.

Mr. L. R. Ferguson, Assistant Secretary of the Association of American Portland Cement Manufacturers, and Mr. Henry S. Spackman, consulting engineer, both of Philadelphia, Pa., also took an important part in the discussion, their remarks indicating that those cements which failed under the autoclave show a higher strength in 6 months than those which passed the test. In other words, the very paper advocating the new test has internal evidence which indicates that the increase in strength in the autoclave has no relation to the strength in a structure. Moreover, the results obtained by the experimenters are exactly what were to be expected, for the Germans, after an experience with the high-pressure steam test, concluded many years ago that it was of no value.

While, therefore, those participating in the discussion did not entirely condemn the test, and indicated that they would pursue their studies farther in order to determine its value, those who have been disturbed by recent agitation as to the adequacy of the present specifications may rest assured that the autoclave method has so far failed to demonstrate its value. There is nothing to prove that a cement bought under autoclave specifications is superior to one passing the standard specifications but failing under the autoclave test.

INCONSISTENCY ITS BRIGHTEST JEWEL

Wonderful to relate—in an article in its issue of October 21, 1913, on the "The Silo—How to Make It Permanent," the Brick and Clay Record recommends concrete for those very parts of the silo which have the chief work to do, the greatest stresses to bear, and the most to endure—namely, the lower four feet or so.

When note is made of the fact that this publication devoted to the Clay Interests has gone out of its way, at every imaginable opportunity, to poke fun at concrete as an undependable and dangerous material, and to denounce the concrete-ward movement as virtually a widespread devil "possession" of the low-down kind that goes not out except by fasting and long prayer, the conclusion is reluctantly forced upon us that "it is to smile."

Inside Facts About Stucco

Troubles of Checking and Cracking Positively Preventable by Use of a Lean Mixture Combined with an Effective Waterproofing Compound

The ease with which stucco lends itself to artistic treatment, has tended toward a precocious development that has been harmful. The trouble is that a stucco job which at first appears to be an artistic gem, gradually develops flaws which may finally overshadow the original beauty.

What is the cause of the "checking" and "hair-cracking?" Is it superficial, or is it hidden in the physio-chemical composition of cement? Much valuable study has been devoted to the external treatment of stucco, but few have stopped to question its internal composition. Let us therefore study some inside facts of stucco mortar.

The subject is an interesting one and the conclusions startling. Who would have thought, for instance, that cement acts like wood, swelling up on wetting, and contracting on drying? But this is proven by careful measurements.

A. T. Goldbeck, of the U. S. Department of Agriculture, showed this in experiments described in *Engineering Record* for July 8, 1911 (p. 45). His researches were confirmed by Prof. A. H. White, working independently in the University of Michigan, and were published in *Engineering Record* for July 15, 1911 (p. 73). Both of these gentlemen proved scientifically and conclusively that mortar and concrete expand on wetting and contract on drying, the action keeping up for years.

In some cases the amount of expansion (due to wetting) was as great as that due to 100 degrees increase of temperature. This is a startling fact, when it is remembered that concrete expands with heat just as much as iron does. The strains due to wetting and drying are therefore very severe, and come quickly and repeatedly. It is not difficult to see why this should be such a serious source of cracking.

It is fortunate that only the cement is affected, the sand remaining practically uninfluenced by moisture. Therefore lean mortars are much less affected than rich ones; a 1:3 stucco when moistened expands much less than a 1:2. But, as Prof. White says, "If a stucco is lean enough to avoid cracks, water will go through freely, and if it is rich enough to keep water out, it will crack."

In Italy, where stuccos have been used for centuries, masonry walls were thick and waterproof in themselves. Cement was made from pulverized natural rock, and lean stucco mixtures were a matter of economy. The passage of ages has developed comparatively little checking in the Italian stuccos. But today, in America, Portland cement is cheap, walls are thin, and climate is severe, so that rich mixtures have been used in the attempt to get cheap waterproofing. The result is excessive hair-cracking.

It is, of course, true that a 1:2 stucco is more waterproof than a 1:3, but it is very much more liable to crack. On the other hand, a 1:3 stucco, properly applied, is safe from cracking, though very porous. This, then, is the dilemma which confronts the constructor: how to make stucco lean enough to avoid cracks, yet non-porous enough to keep out water. The problem has been solved by the use of a 1:3 mortar in conjunction with an effective waterproofing compound.

The leanness of the mortar prevents cracks, and the compound makes the mortar waterproof. This gives absolutely reliable results, both as to permanency of surface and permanency of waterproofing. It is in every way more satisfactory than asbestos or patented stuccos, which do not positively prevent checking and are never entirely waterproof.

Practical experience has corroborated the laboratory in showing the need for lean mixtures; but, as is frequently the case, we did not see the everyday facts in clear light until science opened our eyes. For instance, it has long been known that excessive troweling of a floor, etc., should be avoided. Now we understand that the troweling worked the particles of cement to the surface, making a rich mixture which cracked for the reasons above mentioned.

Some years ago an architect was building a stucco home for himself. The contractor ran short of cement and asked for permission to use a leaner mixture. This was permitted for the back of the house where it wouldn't be noticed, but the richer mortar was insisted on for the rest. To the surprise of everyone, the back wall is still flawless, while the front of the house is full of hair-cracks.

It must be emphasized that with a lean mortar the permanency of the waterproofing compound is a very important point, as the stucco is exposed to beating storms. That class of compound using stearates, oleates, resinates, or other soapy material as a base, gradually washes out under prolonged action of water, which slowly but surely dissolves even stearate of lime. A permanently waterproof stucco is dependent on using a compound that is absolutely insoluble and unaffected by the elements. Bituminous waterproofing products belong to this class; and compounds have been developed which are miscible with water, yet become absolutely insoluble after the mortar has set. This result is obtained by emulsifying the bitumen, which then mixes with water as easily as milk does (milk is an emulsion). But when the mortar sets, it de-emulsifies the bitumen, which then becomes as insoluble as a milk spot. (Butter is de-mulsified milk, and is not miscible with water.)

Bituminous materials so prepared give a very high degree of permanent waterproofing. They are absolutely unaffected by salt-air, brine, running water, boiling water, and ordinary chemicals. Weight for weight they give four times the efficiency of soap compounds, yet they actually strengthen the mortar instead of weakening it, and, because of the lack of all harmful action, the amount of compound is not limited to 2 per cent. If desired, 10 per cent or more may be incorporated in the mixture, and the waterproofing effect correspondingly increased. In this way a factor of safety may be secured which is as important in waterproofing as in other branches of engineering. It then becomes possible to waterproof under guarantee a cellar 50 feet below tide level, by means of a three-quarter-inch interior mortar facing. Evidently this is the kind of material which will give satisfaction also in external stuccos, where no pressure is encountered, but where, on account of the lean mixture, a safety factor is desirable to cover variations in mixing and plastering.

Bituminous materials also lubricate the mortar, en-

*By Ralph L. Shainwald, Jr., A. M., Manager, Impervite Waterproofing Dept., the Standard Paint Co., New York City.

abling a very lean mixture to be troweled easily and compactly. They also retard the too rapid drying-out of the stucco.

We might mention here that if new, green stucco is subjected to the rapid evaporation of hot summer days, great care must be taken to prevent premature drying-out. It must be remembered that the setting of Portland cement is a chemical reaction that requires time and moisture. Mortar will have no strength unless this set is obtained. As mortar dries, it shrinks. This shrinking puts a strain on the mortar which causes cracks if it comes before the cement has sufficient strength to withstand it. If, however, the stucco is kept moist for several days, by means of tarpaulins or fine spray, the cement will harden normally and become strong enough to withstand the strain caused by drying. Soap compounds should be avoided, as they delay the setting, thus causing the mortar to remain weak for a longer time. If stucco is made from a lean mortar, properly waterproofed, properly foundationed, and kept from premature drying, it may be allowed to harden without fear of immediate or subsequent cracking.

On large surfaces the thermal expansion should be considered, especially if the stucco is applied to a base having a different rate of expansion. It may be advisable to divide the surface into panels, having projections which add to the pleasing effect and facilitate the uniform application of the stucco.

The above outline calls attention to a few internal characteristics which are vital. Relieve the stucco of the disrupting strains caused by their disregard, and a worthy material is secured for the best ideals of architecture.

LESSONS TO BE LEARNED

In commenting on the notable investigation of drain tile and sewer pipe conducted under the direction of Professors A. Marston and A. O. Anderson of Iowa State College, Engineering and Contracting says: "This investigation is in all counts the most important study of the loads on pipes in ditches and of the strength of cement and clay pipe that has ever been published. It is a study, moreover, which has been developed with more than usual attention to securing working data and formulas for direct use in actual construction. Before further comment, therefore, credit should be acknowledged and praise given for the enterprise of the college authorities in undertaking this investigation and for their useful discussion of the results secured.

"There are many lessons in detail which can be drawn by engineers from these Iowa tests, but there are certain broad lessons which stand out prominently beyond all others and we note them here. First of all is the lesson that pipe failures under trench filling loads are exceedingly common. Second, it is shown that the strength of drain tile and sewer pipe, as now generally made, is quite generally insufficient to prevent danger from cracking under trench filling in the case of large pipe and fairly deep ditches. Third, it is shown that actual tests of pipe are necessary to determine pipe strengths."

NINETEENTH LUTEN DECREE

A patent decree has recently been rendered in the United States District Court for the Northern District of West Virginia that is of particular interest because it includes the principal claims infringed written out in full and also because its perpetual injunction against future infringement runs not only against the defendants, Boyer, Patterson & Morris, but also against the Philadelphia Fireproofing Company, which

furnished the design on which contract for the infringing structure was awarded. The reason for including the Philadelphia Fireproofing Company was not because they had made the design, but because they had agreed to help in the defense of any suit for infringement on their design, in accordance with the well-known principle of patent law that one who assists in the defense is to be bound by the decree.

The infringing structure was a concrete bridge and the decree finds that eight of the Luten patents were infringed and that they are good and valid in law. This is the nineteenth decree that has been rendered under the Luten patents, which now number thirty-five, on improvements in concrete bridges.

Mr. Luten is the originator of the idea that patents on engineering structures should not be used to prosecute engineers who act in good faith, but only to enjoin those infringing engineers who act in an unprofessional manner towards Luten designs.

TESTS OF CONCRETE

Results of great importance to contractors, engineers, and farmers who have to do with concrete construction are being obtained in a series of tests to determine the rate and the amount of flow of water through concrete. The College of Engineering of the University of Wisconsin, Madison, Wis., is making these tests with the object of finding a simpler means of making concrete water-tight. A large cement company in the middle west is co-operating with the college by offering the facilities of its plant.

Already some interesting results have been gotten in the effect of the length of the time of mixing in a machine mixer of the batch type; the effect of the percentage of mixing upon the imperviousness of the concrete; the effect of having sand in dry condition before mixing; and the effect of having the sand wet.

The experimenters have found that good results are obtained if the concrete remains in the mixer from two to three minutes when dry materials are employed. For cases where the sand and gravel or stone are damp a considerably longer time is required. Therefore the use of wet sand should be avoided if possible. The experiments showed that mixtures consisting of 1 part of cement, 1½ parts of Janesville sand of the Torpedo grade, and 3 parts of Janesville gravel, when mixed to a wet consistency, are impervious to water when subjected to a pressure of 40 pounds per square inch. Mixtures as lean as 1 part of cement to 6 parts of gravel (a graded mixture) have been made impervious at high pressures by using care in proportioning the amount of water and in mixing the batch. The specimens used in making these tests are cylindrical in form and so made that the faces of the cylinders, which are 13½ inches in diameter, are exposed to the predetermined water pressure. The thickness of the concrete through which the water must pass can be varied from 4 to 18 inches. Ample provision is made for cleaning both faces of the cylinder before placing it upon the testing apparatus. The apparatus itself is so arranged that very accurate tests can be made.

The importance of these experiments will be more sufficiently appreciated when it is understood that a large proportion of the trouble arising from poor concrete is due to the use of defective sand or gravel.

The department is also studying the effect of varying the percentages of cement and water, the gradation of the sand and gravel (by this is meant the size of the rocks and the fineness of the sand), the proportioning of the mixture, the thoroughness of mixing, and the effects of different conditions on the hardening of the specimens.

Results of Field Tests of Concrete Disintegration by Immersion in Salt Water

An investigation of the disintegration of concrete by sea water is described in Technologic Paper No. 12 of the Bureau of Standards. This investigation is a part of a general study of concrete disintegration the physical laboratory results of which were summarized in our issue of June 25, 1913. The authors of the study are P. H. Bates, A. J. Phillips, and Rudolph J. Wig. The sea water field tests included tests of compressive strength, corrosive of embedded metal, soundness and tensile strength:

Concrete: 1 Part Portland Cement, 2 Parts Jersey Sand, 4 Parts Trap Rock

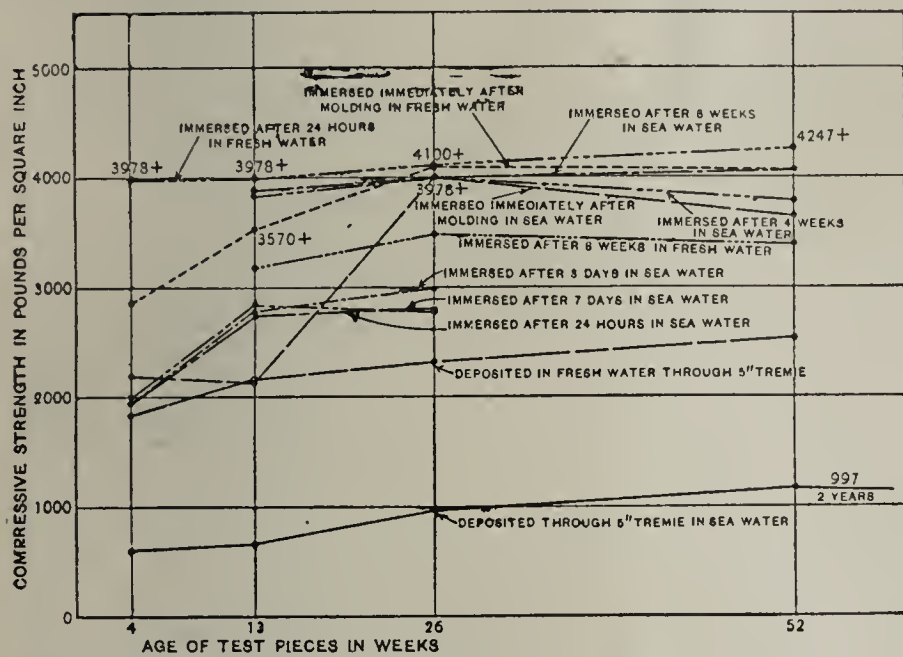


Fig. 24.—Compressive strength of 1:2:4 Portland cement concrete after storage in sea water and fresh water

Concrete Compression Tests

The concrete test pieces were made in the shape of cylinders or short columns, 8 ins. in diameter and 16 ins. in length. They were molded in cast-iron molds the inside surfaces of which were machined and the molds made removable in three sections held together by clamp screws and wedges as shown in Fig. 18.

The concrete was tamped into the molds with a 12-lb. $\frac{3}{4}$ by $3\frac{1}{2}$ -in. peen-shaped tamper. About one-quarter of the height of the mold was filled and tamped at one time, the tamper being lifted to the same height each time and moved systematically, covering the entire surface twice with the tamper at each filling. The top surface was troweled level with a plasterer's trowel.

Where test pieces were molded in submerged molds the concrete was placed through a tremie or pipe. The pipe was 30 ins. in length and 5 ins. in diameter. A cloth was placed over the bottom of the pipe, the pipe was filled with concrete to a depth of about 25 ins., and was immersed until the bottom of the pipe rested on the bottom of the mold, when the cloth was withdrawn from the bottom of the pipe. The pipe was then gently raised from the bottom a little at a time, the concrete flowing from the pipe, which was being continually supplied with concrete so that the level of the concrete in the pipe was always above the level of the water. This was continued until the mold was full, when the concrete was allowed to overflow slightly and the top was somewhat leveled with a plasterer's trowel. After making several series of tests it was found that the same results could be had by filling the molds with sea water, drawing them above the surface of the ocean, placing the pipe as before through the water to the bottom of the mold, and immersing the mold again immediately after filling. This made it easier to handle and fill.

The concrete test pieces were stored in various ways after molding in accordance with the program of tests. Those made in submerged molds were taken from the water after three or four days, removed from the molds, and placed in crates. The test pieces made in fresh water for comparative purposes were also stored in fresh water. Where the concrete was immersed immediately after being placed, the molds were taken off after three or four days and the test pieces placed in crates and suspended in the sea. All test pieces which were aged for periods varying from 24 hours to 8 weeks were stored in a moist room during this time. Twenty-four hours after molding the molds were removed from the test pieces, which were sprinkled each day to keep them from drying until they were immersed either in fresh water or in the ocean.

Results of Tests.—The compressive strength of 1:2:4 proportion (by volume) Portland cement concretes after exposure for various periods to the chemical action of sea water up to the one-year period are illustrated diagrammatically in Fig. 1. Referring to the figure, it will be seen that the concrete placed through a tremie in sea water develops at 4 weeks only about 33 per cent of the strength of concrete similarly placed through a tremie in fresh water, less than 33 per cent of the strength of similar concrete placed in dry molds and immersed immediately in sea water, and less than 25 per cent of the strength of similar concrete placed in dry molds and immersed immediately in fresh water. Although the concrete placed through a tremie in sea water has a low compressive strength, it shows a constant increase in strength up to one year and practically a constant strength up to $3\frac{1}{2}$ years' exposure. The test piece and tremie necessarily had to be small in dimensions, so as to afford opportunity for testing, but undoubtedly a large tre-

Concrete 1 Part Portland Cement, 3 Parts Jersey Sand, 6 Parts Trap Rock or Gravel

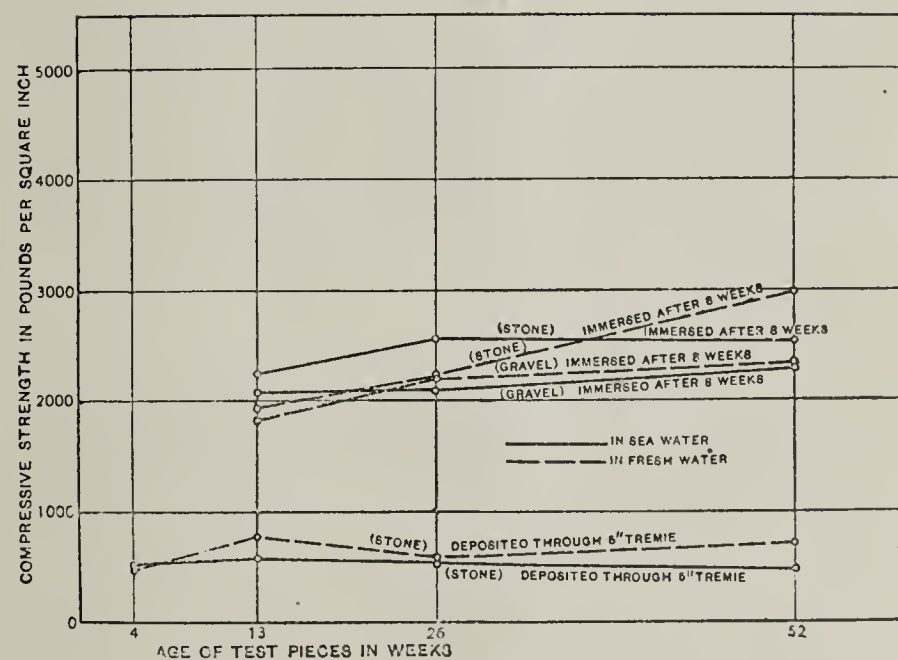


Fig. 26.—Compressive strength of 1:3:6 Portland cement concrete after storage in sea water and fresh water

mie used in large forms would give better quality of concrete, in that there would be less opportunity for the sea water to penetrate the mass. It is essential that a wet mixture be used to fill all voids of the concrete with water before depositing, so as to prevent the agitation caused by the sea water forcing the air from a dry mixture.

Several other methods of placing concrete were tried. Dumping from a bucket and permitting it to settle through the water, the concrete settled in layers of

stone, sand, and cement. In sea water so much magnesia was precipitated and deposited between the particles that the mass had very little or no strength excepting in spots. Magnesia would be deposited between the particles and the aggregate would be separated in a similar way if deposited by means of a trough extending to the bottom of the form. It was not possible to deposit concrete from a bottom dump bucket on such a small scale as to make it at all comparable with practice. But referring to Fig. 1, it will be seen that concrete sets and hardens practically

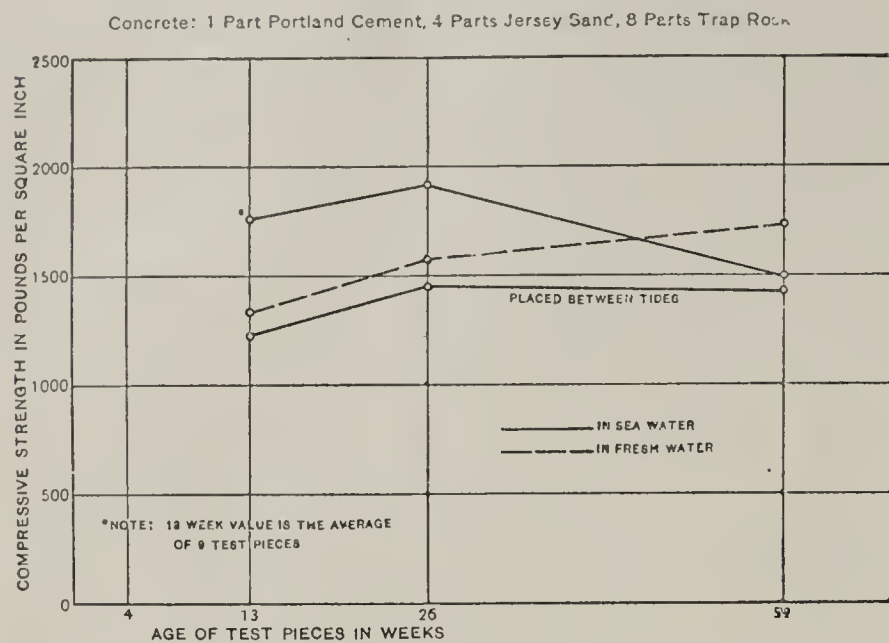


Fig. 27.—Compressive strength of 1:4:8 Portland cement concrete after storage in sea water and fresh water. Test pieces stored for 8 weeks in damp room previous to immersion

as well under sea water as under fresh water or in the atmosphere; thus the problem seems to be one of getting the concrete in place without the separation of the aggregate and with as little exposure of the cement as possible, which causes the magnesia of the sea water to be precipitated and deposited in the mass of the concrete.

With a few exceptions it will be observed that all of the concrete, both that exposed in sea water and that exposed in fresh water, shows a slight decrease in strength from 26 to 52 weeks. It is not possible to state whether this is peculiar to the cement used or whether the freezing winter weather affected the fresh water specimens and that the chemical action of the sea water is responsible for the decrease in strength of the sea water specimens. The fresh water test pieces were immersed in a large iron tank and during the winter, although the tank was covered, there were periods during which the water was frozen solid. In the case of the concrete test pieces aged for one, three, and seven days before immersion in sea water, it will be observed that they were made during October, November and December, when the temperature was comparatively low, so that they would naturally harden more slowly than those made during the spring or summer months.

In order to distinguish between frost action and chemical action, another series of exposure tests have been started, part of the test pieces to be exposed off the northern coast and a part to be exposed off the southern coast.

The 200,000-lb. capacity testing machine was found to be too small for testing many of the 1:2:4 proportion concrete specimens and therefore another series of tests was made of concrete in the proportion of 1 part Portland cement to 3 parts of sand and 6 parts of stone or gravel (by volume). The results of these tests are shown diagrammatically in Fig. 2. The compressive strength of the concrete placed through a tremie in sea water is slightly less than that placed through a tremie in fresh water, although there is not a great difference. The concrete which was permitted to set

or harden for eight weeks before immersion in sea water has more than three times the strength of the concrete placed through a tremie. All of the concrete seems to have a greater strength in sea water than in fresh water after four weeks' immersion, but at later periods the concrete immersed in fresh water is the stronger with one exception. This higher strength after short periods of immersion is also characteristic of the neat tensile briquet tests, but to a greater extent. The results of the 2½-year tests are most significant in showing an increase in strength over previous periods and no deleterious effects from sea water exposure.

In Fig. 3 are given the results of tests of a very lean concrete made in the proportion of 1 part Portland cement to 4 parts of sand to 8 parts of stone. This concrete was so lean it was not possible to place it through a tremie so that it would become hard enough to handle and remove the molds. It will also be observed in these tests that the sea water test pieces have a greater strength for short periods than those immersed in fresh water.

The results of tests of concrete made with different kinds of cement are given in Fig. 4. It is interesting to observe that the concrete made with cement No. 4 has a higher compressive strength at the end of a year than the concrete made with typical Portland cement No. 47. In both of these series the test pieces were made about the same time of the year, although a year apart, so that they were subjected to approximately similar weather conditions. This higher strength value need not be attributed however to the iron content as undoubtedly the same results could be obtained with normal Portland cement.

The strength of 1:2:4 proportion concrete using seashore sand, which is very fine grained and uniform in size, in place of the well-graded Jersey sand, is greater than had been expected and interesting in connection

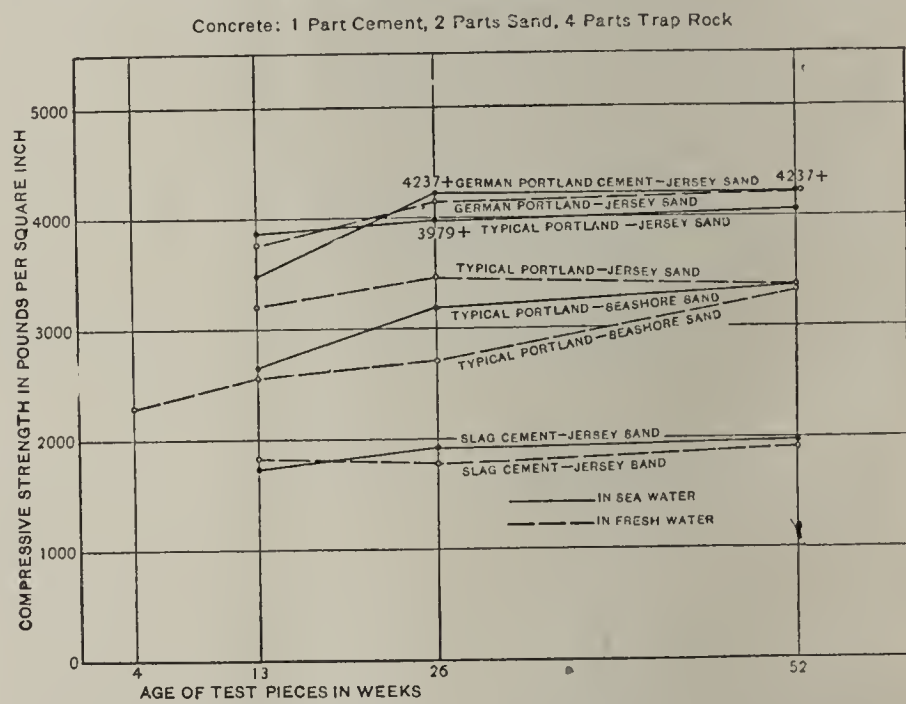


Fig. 28.—Compressive strength of 1:2:4 concrete made with various cements after storage in fresh water and sea water

with the statements of A. Bauchere¹⁷ that even fine-grained sands do not make durable sea water mortars. The results are given in Fig. 4. The concrete made with seashore sand developed about 33 per cent less strength than concrete made with Jersey sand at 4 weeks and 20 per cent less at 52 weeks for that stored in sea water, and about 30 per cent less at 4 weeks and equal strength at 52 weeks for that stored in fresh water. The possibility of temperature and freezing effects should also be taken into consideration in making this comparison.

Corrosion Tests

In Fig. 5 are given the results of a series of compression tests of concrete cylinders made of pit run

Gorgona gravel No. 55. Part of the test pieces were stored in damp room, part in tanks of fresh water, and part in tanks of sea water, tests being made at periods ranging from eight weeks to one year. None of these test pieces were exposed to freezing temperatures, and it will be observed that the concrete exposed to sea water hardened slower than the others, but at the end of one year its strength is slightly greater than either of the others. The initial modulus of elasticity and the yield point were also determined upon these test pieces, the concrete immersed in sea water giving as high or higher results than that immersed in fresh water or stored in the damp room.

In connection with the proposed use of certain types of reinforced concrete piles in the construction of docks at the Canal Zone several series of tests were

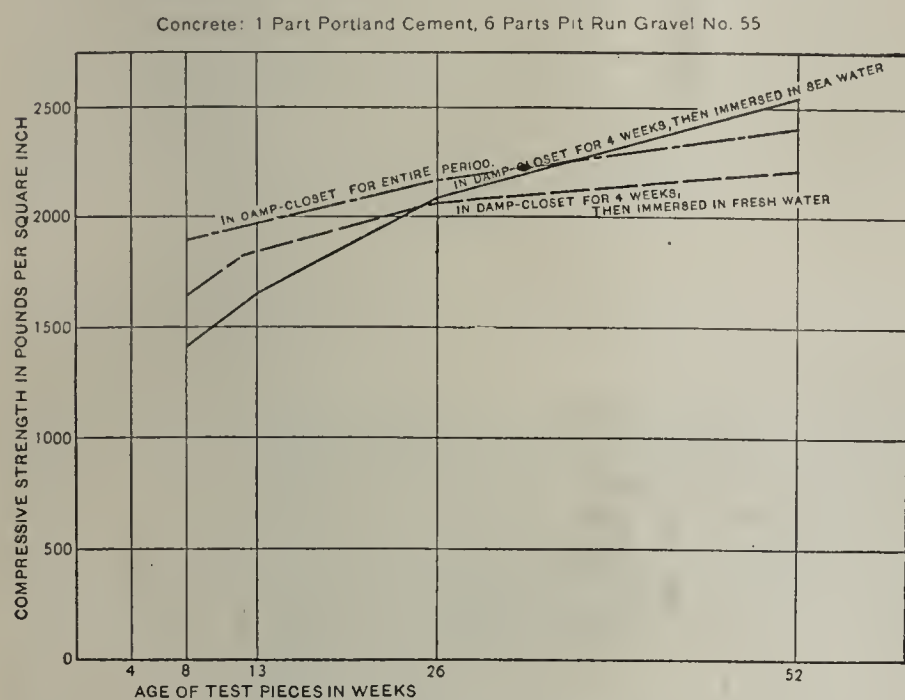


Fig. 29.—Comparison of compressive strength of Portland cement concrete after storage in fresh water, sea water, and damp atmosphere

made with aggregates from the Isthmus having metal of various forms embedded. The test pieces were made as shown in Fig. 6. They were broken open and the embedded metal examined at periods ranging from eight weeks to two years.

The concrete for the test pieces was made in the proportion of 1 part Portland cement to 1 part sand to 5 parts gravel, which was found by test to be the mixture which gave the maximum density for these materials where the ratio of cement to aggregate was 1 to 6. Practically all of the metal embedded within an inch of the cylindrical surface is more or less corroded. Where the metal was placed as shown in Fig. 6a, it is corroded somewhat to the depth of about 1 inch from the cylindrical surface, and in some cases the entire metal is corroded. In the case of the spiral reinforcement, which was embedded within about 1 inch of the cylindrical surface, it was practically all more or less corroded. While the 1:1:5 proportion gave the maximum density for these materials, undoubtedly a mixture containing a greater percentage of fine material would have been more efficient in coating and protecting the metal.

All of the metal embedded 2 ins. or more from the surface is practically clean, and there seems to be no difference in the condition of the metal whether the concrete was immersed or placed between tides.

From the results it was observed that, although the metal in the interior did not extend to the outer surface, the metal within 1 inch of the surface was in most cases somewhat corroded, while that 2 ins. or farther from the surface was practically clean.

¹⁷Manager of the Societe des Cements Francais; Engineering (London), 82, p. 655.

ELECTROLYSIS OF CONCRETE

Technologic Paper No. 18 of the Bureau of Standards, Washington, D. C., has been issued by E. B. Rosa, Burton McCollum and O. S. Peters which is entitled *Electrolysis of Concrete*.

During the last few years attention has been called to the possibility of damage to reinforced concrete structures by stray currents from electric railways and other power sources. The laboratory experiments of Toch, Knudson and Langsdorf in 1906 and 1907 showed clearly that under certain conditions the passage of electric currents from the reinforcing material into the concrete gave rise not only to serious corroding of the reinforcing material but also to cracking and splitting of the surrounding concrete. Since then numerous laboratory experiments have been carried out by various investigators all tending to confirm the earlier observations in regard to the cracking of the concrete but giving rise to various conflicting theories as to the cause of the phenomena observed. Following the earlier demonstrations of the possibility of damage to concrete by electric currents reports of serious damage to certain concrete bridges and buildings became current and considerable apprehension has been aroused in some quarters that great damage may be in progress due to this cause. The subject was brought before the Bureau of Standards by letters of inquiry from engineers, contractors, and corporations requesting information in regard to the probable extent of the damage and the most practicable method of preventing it. In order to place itself in a position to give such information to the public the Bureau of Standards has carried on an investigation consisting of three parts.

1. Laboratory investigation relating to the nature and cause of the phenomena produced by the passage of electric currents through concrete.
2. Investigations in the field with the view of establishing the probable extent of the danger in prac-

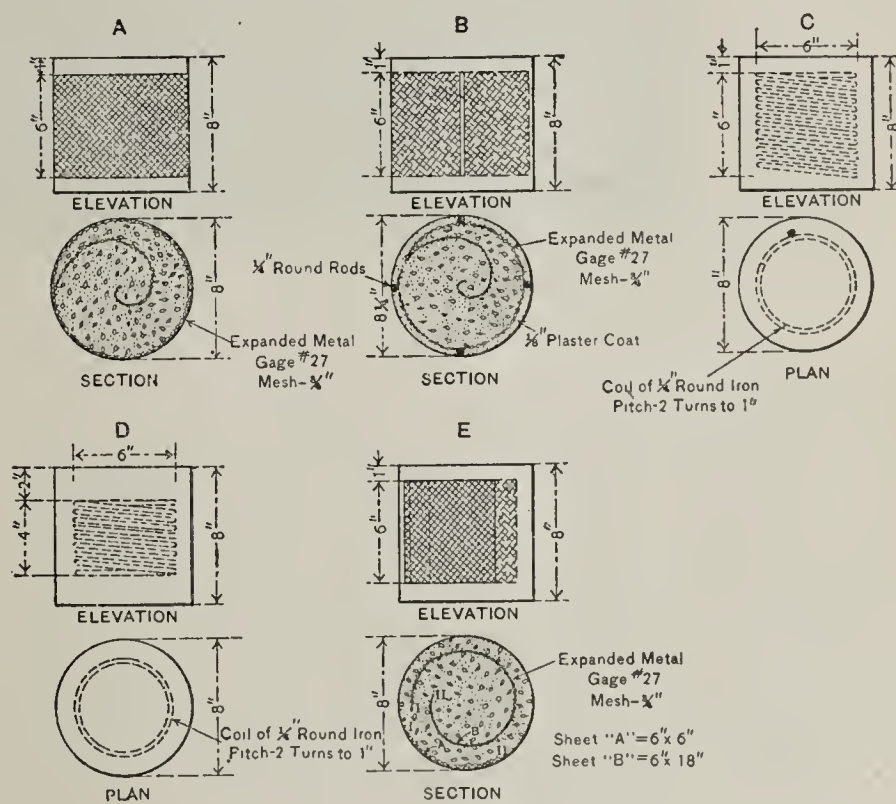


Fig. 30.—Diagram of metal corrosion test pieces

tice and the circumstances under which trouble is most likely to occur.

3. A study of the various possible means of mitigating the trouble from this source, leading to specific recommendations.

The results of these experiments are given in the paper No. 18, copies of which may be secured by addressing the director of the bureau of Standards, Washington, D. C.

Some British Cement Plants

The history of the British Portland cement industry is particularly interesting on account of a period of stagnation through which it passed. The vast deposits of chalk and clay along the Thames and the Medway furnished raw materials of the best quality at manufacturing sites, having admirable shipping facilities. As a result of such fortunate conditions, many mills were erected and the trade flourished for a time. Little by little, however, German mills, operated under the direction of highly educated specialists and equipped with more modern machinery, entered into competition with the British companies for the foreign trade that had been so profitable. Finally the American industry assumed such a standing that the British manufacturers, recognizing the loss of business in the United States and the keen competition of

it is not a difficult matter to procure any quantity of this material in the immediate vicinity. In fact, so closely have the chalk quarries been excavated to the existing roads that occasionally one will see an extraordinary state of affairs, where a road for perhaps a quarter or half of a mile will appear from a distance as if it were a high embankment with vertical sides, whereas really the road is on the old original level and the pits have been excavated on both sides, leaving only sufficient chalk to support the road and a few feet on either side.

In a view of the washing plant of the Northfleet Works, shown in an accompanying illustration, it can be seen that the chalk is dumped from trucks directly into one side of the washing plant. The illustration shows four of these washing plants, and it can be



MIXER, STORAGE AND SLURRY TANKS AT NORTHFIELD CEMENT WORKS.

the Germans, were forced to improve the plants in order to lower the manufacturing costs and improve the quality of their product. In order to do this most efficiently the Associated Portland Cement Manufacturers was formed in 1900 with a capital of about 7,000,000 pounds to take over twenty-eight works belonging to J. B. White & Brothers, Knight, Bevan & Sturge, Hilton, Anderson & Co., Brooks, Shoobridge & Co., Francis & Co., and many other companies. Some of the small and obsolete mills were shut down and a drastic remodeling of the others was begun and has since been kept up.

A short general description of three large works controlled by the Associated Portland Cement manufacturers will serve to show the general features of design and arrangement that have been followed. On account of the fact that two of these original Portland cement works were situated right on the foreground of the chalk formation, the new extensions of them, as might be naturally supposed, are located in the old chalk pits. As the extensive hills of chalk extend back into the country, thousands of acres of which are controlled by the Associated Manufacturers,

seen also that the chalk is dumped into the right-hand side and the clay at the other side, the chalk being quite white in color and the clay of a very dark bluish cast. These washing plants are operated by electric motors situated in the houses shown on the right-hand side, and by means of shafting running underneath the gangway. This shafting extends down the middle, and rotates strong iron stirring arms, which, with the addition of the requisite quantity of water, serve in the first of the washers to stir the two materials into a suitable mixture called slurry, the quantity of chalk to clay being carefully measured and weighed. The chalk and clay are then dumped into the wash mill and the resulting slurry is gradually washed by centrifugal force through a grid into the next wash mill. Here it is submitted to the same stirring process and is washed in the same way through a grid to the next wash mill, the slurry getting finer and finer at each succeeding mill. Finally it reaches the finishing mill, which is entirely surrounded by a fine-mesh sieve that every particle of the slurry has to pass, the residue retained on a 180 mesh sieve being only about 2 per cent.

The slurry is delivered from the finishing mill into mixing tanks by means of plunger pumps, these tanks being shown in another illustration.

Six of the tanks, each 12 feet deep and 66 feet in diameter, are provided, the slurry being kept in constant agitation by means of revolving stirrers attached to the cross-girder, which itself rotates on its vertical axis. The stirrers are operated electrically, the motor being situated in the centre of the girder, which rotates by the resistance of the mixture to the stirrers. From the mixing tanks the slurry is pumped to the upper end of the rotary kilns. The slurry is pumped continuously to a level just above the kilns, a regulated amount of it being delivered to each kiln by a revolving wheel fitted with buckets. At Northfleet there are some sixteen of these rotary kilns which are constructed according to the Hurry and Seaman's patents. The slurry, as it is delivered in regular quantities in the higher end of the sloping rotary kiln, meets with the hot blast from the lower end of the kiln, and what was originally a thick liquid is transformed into a dry material in a very few feet by entirely driving off the water in the form of steam. The latter passes up a stack provided for each kiln, these stacks being of reinforced concrete at Northfleet. The kilns are provided with a series of baffle plates, by which the slurry is made to change its position constantly, so it cannot come rolling down in a mass, each particle being thus submitted to the same intense heat.

The kilns are fired with powdered coal, the supply of the latter for the Northfleet Works being delivered by barges, as the works are situated on the banks of the Thames. This coal is as fine screened as can be procured, and is delivered into a large store house by means of an electric telpherage plant. This small coal is then taken to a series of grinding machines by which it is pulverized. The pulverized fuel is delivered to a large hopper over the end of each kiln, and is fed from these hoppers in measured quantities by a damsel arrangement which blows it into the kiln.

The rotary kilns are revolved by means of electric motors, a complete set of controllers like the ordinary tramway controller being placed on the firing platform to govern the operation of each kiln. All of the other machinery in connection with these kilns is also entirely electrically operated.

From the end of the kiln the clinker drops into rotary coolers immediately below, and from the lower end of the coolers it is discharged by gravity into a pit from which it is taken by means of electrically-operated trolleys to the grinding machinery. The clinker is elevated to the top of the building containing the grinding machinery by means of electrically-operated conveyors that deliver it to a Krupp ball mill. The product of this mill is conveyed to the finishing tube mill, which is 26 feet long and 5 feet in diameter.

This is a brief description of the process of manufacture at the Northfleet Works.

The Associated Manufacturers are equipping the Swanscombe Works with even more modern machinery. Perhaps the two most interesting evolutions at present going on in these works are the entirely new washing machinery which has recently been added and is now being driven by a huge gas engine plant, and the installation for the production of producer gas. This new washing plant has been installed in one of the old chalk pits. The mills in this plant are built on somewhat different lines from those of the Northfleet Works. There are three sets of the mills, each of which is driven by an Oechelhauser gas engine situated in the power house.

As in the Northfleet Works, there are six wash mills to each engine, but the shafting by means of a patent clutch in the middle can be divided, so three of the machines of a set can be stopped at any time desired.

The power house is an extremely long building as compared with the actual power to be delivered, its length being necessary by the fact that the machinery is operated by horizontal Oechelhauser gas engines. It contains three of the gas engines, each having a capacity of 400-450 h. p. The gas is brought to these engines from producers a quarter of a mile away. The producers are of the Mason type and are arranged in a row with a continuous coal bunker over this row.

It is hardly necessary to state that the whole product of the Associated Portland Cement Manufacturers, Ltd., is carefully tested at each of the works in various laboratories. A chemical test is made of the slurry every few hours, and setting-time tests and breaking tests of the cement are continually in progress. The analysis of a freshly-ground sample of one of the typical cements produced by this company is as follows: Silica, 22.00 per cent; sand and insoluble silicates, 0.75 per cent; alumina 7.60 per cent; Ferric oxide, 3.55 per cent; lime, 61.99 per cent; magnesia 1.25 per cent; sulphuric anhydride, 1.50 per cent; carbonic anhydride, 0.25 per cent; water, 0.75 per cent; potash, soda, and loss, 0.45 per cent.

In addition to cement of this character, the Association manufactures at one of its works a special high-grade cement for reinforced concrete work. This cement is made of specially hand-picked clinker very finely ground, and the expansion under the Le Chatelier test for constancy of volume is guaranteed not to exceed one millimetre. A register of tests of all cements is kept at each of the works of samples drawn from each shipment, and the whole manufacture of the company is under the immediate control of the works committee at Park House, Gravesend, where there is an extensive central laboratory for research work.

WOULD USE CONCRETE IN ALLEYS

Henry G. Shirley, chief engineer of the Maryland State Roads Commission, asserts that Baltimore could save thousands of dollars annually through substituting concrete for other materials in repaving the alleys of the city.

"The city is paying from \$2 to \$2.50 a square yard for brick paving for alleys when concrete would be more durable and could be put down for \$1 a yard. Out in Highlandtown there are alleys where contractors have put down thin concrete at low cost, and it is not only durable but can be and is kept clean. It is next to impossible to keep clean a brick or stone paved alley, and concrete is the thing. Where an alley is paved with concrete the women will see that it is kept clean. Most of the city alleys carry little traffic—some of them hardly one team a day. Concrete is the thing; it can be laid smooth and kept clean."

GRINDING PEBBLES

The Canada Pebble Company, Ltd., of Port Arthur, Ont., through the Chicago office operated by George M. Thompson, recently secured the contract for supplying the grinding pebbles to the United States Reclamation Service of New Mexico. The pebbles on this contract are to be utilized in the government cement plant at Elephant Butte, near Engle, N. M.

Slag Products Now Widely Used for Many Purposes

Birmingham, Alabama, is the great Southern center not only for iron, steel and coal, but for slag as well. The slag industry is one that has been growing by leaps and bounds, for this product is now widely used in a number of different ways. The Birmingham

many millions of dollars annually to the Southern farmers. It is likewise true that it was only a few years ago that the blast furnaces in the Birmingham district were only too glad to furnish slag to any railroad or any individual who would dig it and carry it



Lifting Five Tons of Slag at One Scoop at the Plant of the Birmingham Slag Co.—Furnace in Distance.

ham Slag Company, which controls practically the entire output of this district, is the largest enterprise of its kind in the United States.

Slag and cotton seed are wholly dissimilar products, but their history furnishes a rather interesting parallel. It was not many years ago that cotton seed was absolutely without commercial value, and the farmers were only too glad to get rid of it. Now cotton seed brings

away. While it now has recognized commercial value, yet it is still sold at a price that makes it the cheapest, and in most respects the best material for concrete work, roofing work, railroad ballast and street and road work. However, if the commercial demand continues to increase at the present rate, the price of slag, F. O. B. the pit, will in all probability be forced upward, as the reserve stock is limited.



Bird's-Eye View of a Portion of the Slag Pit Operated by the Birmingham Slag Co., at Ensley, Ala. This Is Probably the Largest Slag Pit in the United States; 1,500 Feet Wide, 1,500 Feet Long and 103 Feet Deep at the Highest Point. Two Marion Steam Shovels, Manufactured by Marion Steam Shovel Company, Marion, Ohio, Were Operating in This Pit When Picture Was Taken.

The production and distribution of slag has become an immense industry, and one in which architects, builders, city and county officers and all tax-payers are equally interested. One of the most interesting industrial sights in the Birmingham district is found in the slag digging operations at the large pits of the Birmingham Slag Company. This company controls 90 per cent of the blast furnace slag produced from furnaces located in the state of Alabama and, in addition to their slag pits at Oxmoor, Gadsden, Ironton and Sheffield, Ala., the company has constantly in operation in the Birmingham district, four huge steam shovels which dig and load the slag, and six locomotives placing empties and delivering loads for shipment to the various railroads entering the Birmingham district, all of which the company handles on its own rails. The company has altogether about twenty miles of railroad tracks in the district, and its daily loading will average about two hundred carloads or about nine thousand cubic yards. The daily tonnage shipped by this company is greater than any other concern in the South with the exception of the United States Steel Corporation.

The company also operates a crushing and screening plant, which produces sized slag for all manner of concrete construction, and also for roofing purposes, and is preparing just now to install, at the expenditure of approximately \$25,000 an entire new and up-to-date screening plant, which, it is stated, will be able to supply promptly, the ever increasing demand for concrete and roofing slag carefully sized and absolutely free from slag dust or foreign matter.

Slag as a road building material possesses some advantages that are entirely unique. In the first place it is in itself a cement rock. Rolled and wetted down during the process of road building, it cements itself into solid concrete. It is an impervious material, absolutely pure and free from loam. It weighs less than stone or gravel, and this reduces the cost of rail and wagon transportation. The Birmingham Slag Company has carried on a campaign of education as to the availability of this material for road construction purposes. And many cities and towns in the Southeastern States are now constructing their streets and highways exclusively of slag, while others are investigating this material with satisfactory results.

Roofing slag is growing in use, having advantages that are recognized by all well-posted roofing concerns and general contractors. In the first place it is very light. It can be shipped to the contractor properly sized and free from dust. The particles of slag have a rough surface and this causes the tar or asphalt to adhere more closely than when smoother materials are used. Besides, roofing slag is much cheaper than gravel, because it costs less and will spread over a greater area. The advantages of slag for all manner of concrete construction are obvious, and its use for this purpose is steadily increasing.

It is very interesting to note that blast furnace slag and lava are similar materials, both in chemical analysis and many other peculiarities, both being the residue material blown from the molten interior of huge furnaces and cooled slowly in the air.

DRAIN TILE MACHINE

C. W. Sandell, manager of the J. C. & S. Company of Hillsboro, Ind., manufacturers of cement drain tile, stated the other day that he is operating a Dunn tile machine, manufactured by the W. E. Dunn Mfg. Co., 4139 Fillmore street, Chicago, and that he is more than pleased with it. Mr. Sandell said the Dunn machine cost two-thirds less than the larger power tile machines and that it is worth ten times more.

HY-RIB STEEL SHEATHING

It is wonderful what a difference there is to be found between catalogs. Some seem gaunt, as if the compilers had difficulty in finding enough desirable matter to fill the desired space. Others are just the opposite, overcrowded with variety and profusion. The ideal catalog is one that impresses the reader with the worth and comprehensiveness of its contents. That quality of comprehensiveness is well brought out in the latest edition "Hy-Rib" catalog of the Trussed Concrete Steel Co., Detroit, Mich. The catalog certainly conveys the idea that there is a lot to know about "Hy-Rib" for roofs, floors, walls, sidings, partitions ceiling and furring and for silos, tanks and conduits, the construction of concrete without forms. This catalog of 112 pages abounds in illustrations showing Hy-Rib in almost innumerable applications. The illustrations are so well chosen that they in themselves answer the queries that might arise in the mind of the reader. Everything is made plain.



"Hy-Rib Concrete Silo," University of Nebraska Farm, Lincoln, Neb. Erected by the Concrete Silo Company, Lincoln, Nebraska.

methods of application, devices used and a lot of interesting side lights. And in the following manner the publishers tell at the outstart something about the product, this and a lot more which space does not permit to here republish:

Hy-Rib is a steel sheathing stiffened by rigid high ribs. The ribs and the lath are manufactured from a single sheet of steel, making it a complete unit of lath and studs.

No forms are required where Hy-Rib is used in concrete floors and roofs as the ribs give sufficient strength and rigidity. In walls and partitions Hy-Rib does away with the use of studs. The lath surface is straight and true and the expansion is such as to provide a perfect clinch with a minimum amount of plaster.

Hy-Rib is furnished in either straight or curved sheets, both possessing the same advantage of economy and strength. Curved Hy-Rib eliminates expensive circular forms besides reinforcing the concrete.

Spraying Freshly Made Concrete Blocks

As to the use of a spray in removing the film of cement and disclosing the quality of the facing material in the manufacture of concrete block, I give our method as follows:

Immediately upon removing the block from the machine, place it where there will be a good light on the face and spray it, using a fine vapor spray, such as is used in spraying fruit trees. The outlet holes in such sprays are about the size of an ordinary pin and for the best results should be used in connection with a water pressure of 40 lbs. or more. This spray nozzle attached to a length of $\frac{1}{2}$ -in. hose is all the extra equipment needed and the spraying is a very simple

things in one simple operation. First, to expose the color of the sand; second, to give to a semi-dry facing mixture the water needed to aid in the proper crystallization of the cement before the initial set had taken place; third, to remove mold marks and to give to the surface a roughened effect, equal to fine bush-hammering.

This process at first was of little value, when used with dark cement and ordinary sand, and it was not until white Portland cement came on the market and a suitable sand or crushed stone could be obtained, that it could be made of commercial value.

We have previously stated that the facing mixture



West Seneca Town Hall, West Seneca, N. Y.
Morris & Allen Contractors.
Over One-half Million Sand Lime Brick Used in Construction,
Manufactured by Buffalo Sandstone Brick Company.

operation which, with a little practice, can be done effectively by any intelligent laborer. The object and the effect of the spraying are as follows: It is well known that one of the greatest objections to the ordinary cement block has been, and is, its dull, lifeless appearance. No matter what kind or color of sand or crushed stone is used for facing, a certain amount of cement adheres to each grain, hiding the natural color and giving to the block the color of the cement used. White sand will give a lighter effect than dark sand, but in either case the entire surface is one color, dull and for many uses, unattractive.

Our process is to give a mottled effect, exactly the same as in fine, high-grade granite, where you see the black mica set off by the white or light gray of the quartz crystal in which it is imbedded. The originator of the process described had for years the idea of spraying a green concrete block to wash the cement from the particles of sand, before it had had an opportunity to set, thereby accomplishing three

should not be made too wet. Our reason for this is that we do not want to lose the cement from the face of the block, which, if the facing were too wet, would stick to the mold.

Our object in spraying is to wash this cement from the face of the sand and, by having the facing dry enough to come away clean, there will be suction created through the absorption of the water from the spray, which will carry the cement in between and around each particle of sand, not only uncovering its face, but allowing it to stand out slightly from the cement, thereby giving the cut-stone effect, before mentioned. If the facing is too wet, less water can be given with the spray and the tendency is for the cement to wash down over the sand, instead of away from it, and the whole to sag and run.

In spraying, where the facing has been properly mixed, watch closely and give all the water it will take without sagging. For the regular line of block, nothing more need be done except to cure in the usual

way, either by steam or by sprinkling. For special and ornamental work, it is best to spray again, one or two hours after, and as soon as the cement has set so that there is no danger of its washing, give it all the water it will take. Turn the hose on all work that will stand it before closing the factory each night and again the first thing in the morning. This, of course, applies to work being cured by sprinkling and not by steam.

Steam curing is recommended. Spraying begins the good work by giving moisture when it is most needed, but it is impossible to give a sufficient quantity of water at the first operation, to penetrate the facing more than $\frac{1}{4}$ in. Steam completes the curing in the most satisfactory manner, by penetrating entirely through the stone, producing perfect crystallization. Sprinkling produces good results when properly attended to, but it is apt, by many, to be neglected or only half done. When sprinkling with the hose, be sure to cover all parts of the face and go over it several times, giving opportunity for the water to be absorbed, rather than run off the face and be wasted. The spraying process tends to make the face more nearly waterproof than any other method, except where special compounds are used, and it is therefore desirable to sprinkle as soon and as often as possible, before the cement has set sufficiently to repel the water.

Where steam is not used and it is desired to have some special pieces perfectly cured, we recommend giving them a bath by placing under water long enough to take up all the water they can possibly hold. Repeat the bath for several days and keep the stone in a damp place or cover them from the air and sun.

Another important advantage in using the process described is in patching broken or chipped pieces. In smooth, ordinary work, it is impossible to patch without it showing. With our process, if a corner or edge is broken down while making, first spray the part slightly, then apply the patch, doing as little troweling as possible, and spray the whole again.

The water will settle the patch and obliterate any dividing line. The same will apply to patching a stone broken after it has set.

The same effect can be produced on a block face up as on a vertical face and where there is facing to be done on the back of a block which is to be turned from the mold onto a pallet, it can first be sprayed, then placed on a smooth, clean pallet and all sides will come out alike.

On general principles we do not recommend the use of any waterproofing compounds in the facing of any concrete stone made by the semi-dry process, where it must get its strength largely from the water added after the stone is molded and during the process of curing, writes C. C. Thompson, Syracuse, N. Y., in "Concrete-Cement Age."

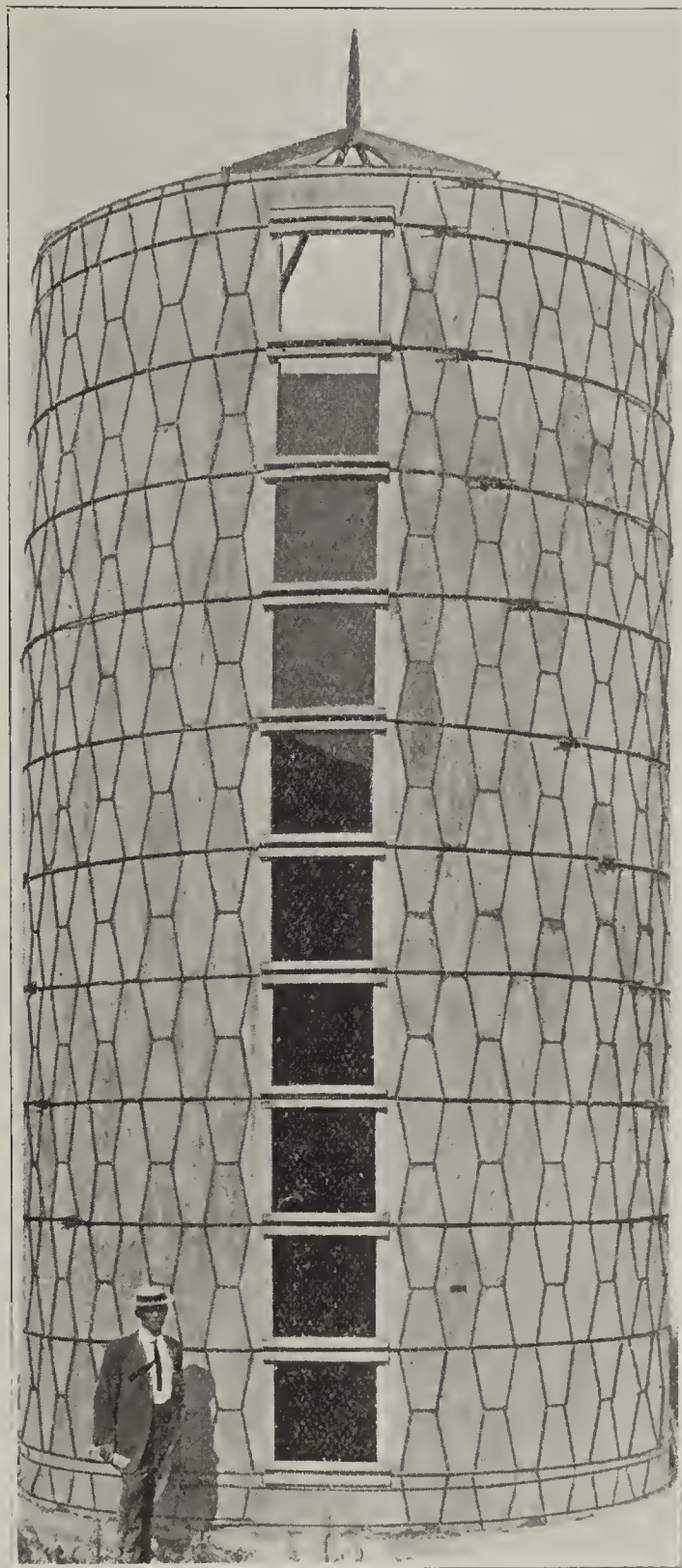
When, however, it is desired to use such waterproofing compounds, use only those that will mix with water. Such as will not mix with water exercise the waterproofing qualities immediately and prevent the facing from absorbing the water from the spray, or that given by sprinkling. The facing therefore never gets water more than that given in mixing, which is not sufficient for the best results. Give plenty of water during the process of curing, keeping all work well soaked for a week or 10 days, when it will be as nearly waterproof as is required for all practical purposes. After being erected in the building, a liquid waterproofing can be applied if desired. It is recommended that block manufacturers using the spraying process give personal attention while experimenting

and watch closely the change in appearance of the surface of the stone the instant the spray strikes it and also to note the amount of water that the facing will absorb before sagging.

The entire operation is simple, but effective, and adds little to the cost of production, while from 25 to 100% can be added to the selling price.

CONCRETE STAVE SILO

The Diamond Concrete Stave Silo Company, made a most creditable exhibit of one of their Diamond concrete stave silos and a stock water tank, of the same form of construction, at the Texas State Fair. This



silos is unique in construction. The concrete staves are manufactured at the factory and shipped to the place of erection. These staves are made of one part cement, two parts sharp sand and two parts crushed rock, or clean gravel.

The staves are thirty inches long; the ends are six inches in width; through the center of each stave the width is $11\frac{1}{2}$ inches; the edges of each stave are alternate convex and concave, leaving, however, sufficient space between the joints, into which "neat cement" is poured, thus making a solid water-tight joint.

When this silo is erected, a water-proof cement preparation is placed upon the inside wall, insuring the silo proof against any detrimental action of the alcohols and acid juices in the silage.

The company warrants that these silos will not blow down, or rot, or crack; it is self-evident that they will not burn.

The water tank construction, as well as the silo, was a source of most favorable comment by the Fair visitors.

The company contemplates locating factories at suitable points in the corn belt and silage producing states to manufacture silos and stock water tanks.

The picture of this Diamond concrete silo shows the form and manner of construction. The prices demanded for the silos are but a trifle more than a good wooden stave silo; this fact will insure this company a very large business in the silage producing states.

The demand for silos throughout the United States is very great, and a silo that is warranted not to blow down, crack or burn down, surely stands at the head of the list.

inforcing in taking up the stresses of concentrated loads in providing the best possible cement bond and saving time and labor in the construction of Concrete Culverts of every size and kind are clearly and simply explained. In addition to specifically describing conditions which govern concrete reinforcement construction of culverts—helpful information of value to everybody interested in good roads and their making, is to be found on every page. Under the head of "Concrete Culvert Types" you will find data of great value of determining when and how to use Circular Culverts, Arch Culverts or others of the "steel girder" type. How the use of expanded metal or steel fabric has reduced the cost on the construction of culverts; how it insures absolute distribution of stresses between the meshes utilizing the comprehensive value of all concrete bedded in meshes; how the floors of steel girder culverts and bridges may be reinforced and concreted at a great saving of time, labor and material expense; how to determine the exact amount of steel required for any concrete culvert or bridge, together with accurate tabulations regarding weights,



Constructing a 15-Foot Span, Reinforced Concrete, Arch Culvert, Lincoln Township, Grundy County, Missouri.
"Econo" Expanded Metal Lath Reinforcing Used.

CONCRETE CULVERTS

A new booklet "Concrete Culverts" just issued by the Northwestern Expanded Metal Company, Old Colony Building, Chicago, will be sent to any of our readers upon request. "Concrete Culverts" is an illustrated booklet containing the most comprehensive array of specific, timely and helpful ideas and methods covering every phase of reinforced concrete Culvert Construction ever squeezed into a 24-page publication of this character and every progressive Engineer and Contractor should have a copy on file in his office for ready reference, writes an official of the Company.

The unsurpassed advantages of "Econo" steel re-

gauges, widths and lengths of "ECONO" Steel Reinforcing are also given. It has been truly said that this new Booklet No. 8 on Concrete Culvert Construction, together with our vest pocket data book numbers 1 and 2 contain the greatest mine of practical information on the subject of concrete construction obtainable, and we shall be glad to send any one or all upon request.

TO INCREASE CAPACITY

The Clinchfield Portland Cement Corporation, Kingsport, Tenn., is to increase monthly capacity from 60,000 to 100,000 barrels.

The American Aerial Tramways, Bleichert System

(Succeeding the Trenton Iron Co.)

Using American Wire Rope

The Bleichert System of Aerial Tramways is one whereby the material is carried in receptacles suspended from carriages running on stationary overhead cables in a continuous circuit, the loaded carriers along one cable and the empties returning along a lighter cable parallel with this, motion being imparted by means of a light endless traction rope to which the carriers are gripped.

No matter what the contour of the ground a Bleichert tramway will take the material in a bee line from where it is produced to where it is to be delivered without rehandling at a cost of 2 cents to 5 cents per ton a mile.



Fig. 1. Support in Bleichert Tramway.

Angles may be made wherever it is necessary to change the direction of the line, but should be avoided wherever possible as adding to the first cost of the line and nearly always to the cost of operating.

Intermediate loading and discharge stations can be introduced at suitable locations if required, also inter-

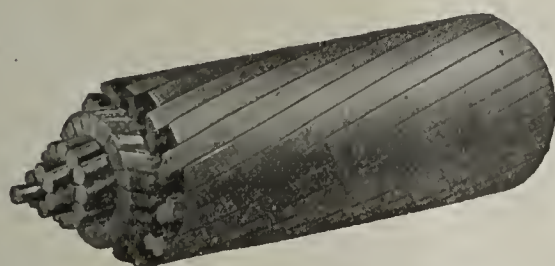


Fig. 2. Patent Locked Coil Track Cable.

mediate brake or power stations according as power is developed or required, in cases where it is necessary to divide the line into sections:

No ground is too rugged for a bee line route; no grades too steep to surmount; no rivers or valleys too wide to cross; no grading, bridges or viaducts are required.

Structures are required to support the cables. These may be spaced varying distances apart according to the contour of the ground and structures are also required for applying tension to the track cables, wherever necessary in the longer lines to maintain their proper deflection. The supports may be of wood or



Fig. 3. Patent Coupling.

of iron as preferred and are designed to correspond with the service and special condition of the location.

There is practically no limit to the length of a Bleichert tramway. One line carries ore a distance of 21 miles. The loading terminal is 11,600 ft. above the discharge terminal and the capacity of the line is 40 tons per hour.



Fig. 4. Carrier With Webber Patent Compression Grip, Showing Patent Automatic Attacher.



Fig. 5. Carrier With Bleichert Patent Automatic Overhead Grip.

Spans occur in this line exceeding half a mile in the clear. Spans over 1,000 ft. in any line are not unusual but the spacing of the supports under ordinary conditions will average 200 to 300 ft.

The track cables are of patented locked-coil construction (Fig 2) the smooth surface of which conduces toward a very uniform wear, which adds to the life of the cable and of the wheels that run on it.

These cables are made of a select grade of steel, in lengths varying from 500 to 1,500 ft. which are joined by patented steel couplings illustrated in Fig. 3.

The grips for attaching the carriers to the traction are simple in construction, powerful, strong and efficient.

They are made of ropes running below or above the track cables according to the exigencies of the case, as shown in the cuts above. Fig. 4 represents the ordinary form of carrier with underhung grip suspended from a terminal rail, in the act of being mechanically attached to the traction rope. Fig. 5, a carrier with the Bleichert patent automatic overhead

grip; and Fig. 6. a carrier with the Bleichert patent automatic underhung grip.

In the latter two the grips form an integral part of the carriage construction and operate in such a way that the weight of the carriers in any case acts as the gripping force in closing the jaws against the rope.

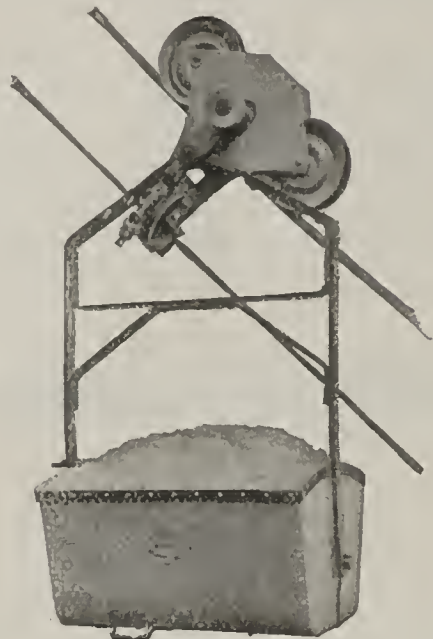


Fig. 6. Carrier With Bleichert Patent Automatic Underhung Grip.

These grips, therefore, are independent of any nice adjustment of the jaws and automatically accommodate themselves to irregularities of the rope which is a great advantage in long lines.

An overhead grip with positive operating mechanism is also made.

Well tried devices are provided for attaching and detaching the grips automatically at the terminals and other stations as may be required.

No buttons, lugs, or knots of any kind are required on the traction rope. This fact adds greatly to the life of the rope, since the wear is distributed uniformly over the entire rope and not confined to certain spots.

The same advantage pertains to these grips as compared to permanent connections of any kind. The ability to strip the line readily of its carriers when occasion occurs for resplicing the traction rope, or while making repairs is of itself a very great advantage.

Receptacles especially designed for any purpose are made of all kinds of materials. Buckets are most commonly used as shown in the illustration above, and these may be self-dumping if desired.

By cars especially designed to hold one or more buckets, the material may be transferred to and from surface tracks at the stations without rehandling.

Scales are furnished, if desired, specially designed for weighing the loaded carriers, or counters for automatically registering the number transported. For further information write the American Steel & Wire Company, Chicago, Ill.

REINFORCED CONCRETE BUILDING

The United States Rubber Company, is building a new addition to their Indianapolis plant and using reinforced concrete for frame, floors and roof because, in their experience, it is possible to keep the interior of a reinforced concrete building at a temperature as low as 50° or 60° F., through the warmest weather. The storage of rubber goods requires a reasonable low temperature and a concrete building meets this need admirably.

Albert Mahn designed the building for the owners and the Trussed Concrete Steel Company, of Detroit, furnished the reinforcement. It was built entirely with Universal Portland cement.

TURNER SYSTEM OF CONCRETE CONSTRUCTION

Two views, one exterior and one interior, are here-with presented of the Woodward-Wight Company building, New Orleans, La., recently erected. It is a large structure, 185 by 230 feet, five stories and basement, and is to be used for wholesale warehouse



Interior View Woodward-Wight Building. Mushroom System of Reinforced Concrete Construction.

purposes. It was erected at the remarkable rate of one floor in six working days after the foundations were laid. The Mushroom System is used throughout. The Mushroom System is the Turner System of Reinforced concrete construction, manufactured by C. A. P. Turner, Phoenix building, Minneapolis, Minn.

Bulletin 12, recently issued by Mr. Turner, containing 72 pages, abounds with other examples of this construction, besides telling all about it. The bulletin



Interior View Woodward-Wight Building. New Orleans, La.

may be had for the asking. The Mushroom System is so-called from the peculiar formation of the rods around the column head and from the remarkable rapidity with which it may be erected. The idea of

this system is primarily to simplify the centering and thus reduce the cost of the temporary part of the construction without skimping the materials in the finished work. Over two thousand acres of this construction has been completed or contracted for during the first four years that it has been on the market.

The arrangement of the reinforcement is designed with a view of securing the maximum efficiency of the materials through straining the concrete in a number of directions, the compression in one direction tending to balance and offset that in another; incidentally to concentrate the maximum amount of reinforcement around and over the support where the shear is the greatest, to enable removal of the forms at the earliest possible period, and finally to eliminate beams and ribs which interfere with light and catch dust, cost money to plaster and finish, and reduce the clear story height. The flat ceiling so obtained gives free and unobstructed illumination from the windows; it permits one to place partitions anywhere without regard to the floor, giving an unusual stiffness and solidity due to the fact that a part of the material which in the beam type is placed in the ribs, is consolidated in the slab, making the slab of unusual thickness with an actual decrease in the total amount of material where the loads are at all heavy.



CONCRETE BRIDGE OF LUTEN DESIGN NEAR GEORGETOWN, IND.

CONCRETE BRIDGE AT GEORGETOWN, INDIANA

The beauty of a concrete arch bridge is largely inherent in its graceful arch lines, yet the work of harmonizing the bridge to its site and designing approaches and railing in keeping with the simplicity of the arch furnishes a problem for the expert designer. The best examples of concrete bridge engineering are generally subjected to careful architectural study and this is essential if the full possibilities of the concrete arch are to be realized.

One of the best of recent bridges is a five-span structure over the Wabash River in Cass County, Indiana, eleven miles below Logansport, and known as the Georgetown Bridge. It replaced an old wooden bridge supported on masonry piers that had been carried out by ice in the spring of 1912 and is as typical of modern bridge engineering and architecture as the old wooden trusses were of the methods of forty years ago.

There are two 90-foot end spans, two 110-foot intermediate spans and a central 120-foot arch, with a maximum height of roadway of 31 feet above the bed of the stream. The railing is exceedingly simple, as may be seen from the illustration on this page. All plain surfaces were rubbed with carborundum block except the large triangular panels on the sides. In these the coarse aggregate was exposed by washing, giving a strong color contrast noticeable from a distance, as well as a decided contrast of texture. The curved wings at the approaches are unusual and add much to the appearance.

A single concrete mixing plant, installed at one end, served the whole work, concrete and other construction materials being delivered in industrial cars running on a temporary trestle at one side until the arch rings were complete, and on a double track supported from the arch rings during the balance of the concreting and for placing the earth fill.

The bridge is of Luten design and was built by the National Concrete Co. of Indianapolis.

STATE QUARRIES IN WASHINGTON

The state of Washington owns five rock quarries at sites selected by Prof. Henry Landes, state geologist, for the superior quality of the stone as road material. The rock at one is feldspathic sandstone, at the others is basalt. Two of these were placed in operation in 1910, the others in 1911.

They were originally designed to provide first class material at low cost for use on state and state aid roads, the general idea in 1910, when they were purchased, being that these would be of bituminous macadam on a macadam base. Since then the state aid law has been repealed, no appropriations for state roads were made in 1911, and several of the counties (which

now do work formerly done by the state highway commissioner) have opened quarries of their own.

In addition to these conditions there has been a strong movement toward concrete road construction, allowing the use of gravel instead of crushed rock because of its lower cost or greater accessibility. Orders on the state quarries have therefore been spasmodic and not very large. With the exception of two months out of the eighteen ending September 30, 1912 (two seasons), not more than three quarries were running at any one time, and most of the time only two.

In spite of this, it was possible to operate the five quarries, provide crushed rock to fill all orders received, and to improve one of the quarries at a cost of \$6,000 to put it in better working condition, to do considerable development work at the newer quarries during the winter of 1911-12, and accumulate a surplus of \$4,165.64.

A description of one of these quarries (known as the Meskill quarry) and the figures showing the cost of production there are given below as an illustration of this feature of the state work. These are from the report of W. J. Roberts, state highway commissioner, for the two years ending September 30, 1912.

The Meskill quarry of 160 acres was donated to the state by Lewis county. It is on a branch of the N. P. R. R. and has no water transportation. The power line was built from Chehalis and is about fourteen miles long. Three-phase 2,300 volt current is furnished and the state transforms to 110 volts for small motors and lights.

The crushing plant consists of an Austin No. 6 gyratory, main crusher, manufactured by Austin Mfg. Co., Chicago, Ill.; Austin No. 6 standard elevator, 68 feet long; Austin No. 6 revolving screen, 20 ft. x 40 ins., three sections; motor, 75 H. P., operating main crusher, elevator and screen; Austin No. 3 gyratory-auxiliary crusher for regrinding oversize from No. 6 crusher; motor, 30 H. P.

The bunkers are of the center loading type with standard railroad clearance. Capacity 750 cu. yds.

The side track is 1,450 feet long from head block to head block, and has a length available for car storage of 1,150 feet, affording room for twelve empty cars and thirteen loaded ones.

The quarry equipment comprises a Rand air compressor 12 $\frac{1}{4}$ x12 ins. capable of furnishing compressed air for two 3 $\frac{1}{4}$ -in. drills; an electric motor, 50 H. P.; two "Wood" air drills; Deane triplex 4x5-in. pump operated at present by air compressor motor and used for washing rock and removing overburden; nine 15 cu. ft. end pump quarry cars; blacksmith outfit complete.

A Buffalo pump 2 $\frac{3}{4}$ x4-in. direct connected to electric motor, 3 H. P., supplies camp from well; gasoline engine, 2 H. P., and pump supplies water for air compressor.

When producing sizes in the proportions for which they were designed, the crushers will grind approximately 250 yards per day. When regrinding for small sizes only, the capacity is materially reduced. Were it not for the toughness of the rock, a greater output could be obtained.

The plant and buildings cost as follows:

Crushing Plant:	
Machinery and tools.....	\$9,930.02
Building (setting machinery, inc.)..	8,999.21
Side track	822.31
Power line	4,000.00
	\$23,751.54
Camp:	
Buildings and stockade wall.....	\$8,062.99
Water supply	533.20
Furniture and camp equipment....	774.33
	9,370.52
Engineering supervision and traveling.....	1,877.94
Total	\$35,000.00

There is given below a record of operation at Meskill quarry for two months. The one for February, 1912, shows a very high cost, while that for September shows a very low cost. No elaboration is necessary to demonstrate that rock cannot be sold on the basis of cost in a good month or in a poor month, but that an average cost must be taken and sufficient profit added to create a sinking fund for the upkeep of plants and the ultimate repayment of their initial cost.

Meskill Quarry, February, 1912.

Salaries and wages.....	\$396.55
Subsistence	178.12
Clothing and shoes.....	19.00
General supplies and expense quarry...	33.69
Power, light and heat.....	65.27
Repairs	.40
Tools	5.38
General expenses, Olympia.....	160.53
Total cost of operation.....	\$858.94
Received from sale of rock.....	360.00
Operated at a loss.....	\$498.94
Cubic yards rock sold, 500.	
Cost per cubic yard, \$1.72.	

Notwithstanding the low total cost, the cost per cubic yard was high because the orders were light. The spare time of the men was profitably occupied, however, by the removal of overburden, preparatory to the next summer's run.

Meskill Quarry, September, 1912.

Salaries and wages.....	\$490.00
Subsistence	277.77
Clothing and shoes.....	24.86
General supplies and expense quarry..	91.60
Power, light and heat.....	122.68
Repairs	177.26
Medical	.50
Tools	6.78
Powder	111.91
General expense Olympia.....	95.80

Total cost of operation.....	\$1,399.69
Received from sale of rock.....	3,011.00

Operated at a profit of.....\$1,611.31

Cubic yards rock sold, 4,305.

Cost per cubic yard, \$0.33.

The organization at the quarry, when running at capacity, consists of seven free men and thirty-five convicts. The force is made up as follows: Superintendent, clerk, foreman, mechanic and three guards. One guard is on night duty and two are on day duty. All of these seven men, except the guards, would be necessary for the operation of a free labor quarry.

The division of convict labor is as follows:

Camp crew.....	4
Blacksmith	1
Mechanic's assistant	1
Crusher feeder	1
Burley men	2
Quarry	26
Full crew	35

The camp crew consists of a cook, cook's helper, laundryman, and a fourth man who keeps the bunk houses and officers' quarters clean, distributes the coal and wood, and acts in other capacities as a trusty.

The blacksmith sharpens the drill steel and does such iron work as is needed for repairs.

The mechanic's assistant is generally a handy man about the machinery. The paid mechanic, blacksmith and mechanic's assistant are supposed to keep the plant in constant operation, and there have been very few shut downs for repairs since this plan was adopted.

The crusher feeder distributes the rock into the crusher as it is dumped from the quarry cars, equalizing the crushing strain.

The burley men operate the air drill, bar down loose rock from the ledge, and load railroad cars.

The quarry crew is divided, as a rule, into six groups of four each, with two extra rock breakers. Each group is assigned a station and car and must move its share of the day's output from the quarry to the crusher.

The plan of the Board of Control in furnishing these prisoners is to construe the quarries as parole camps and send men who after nine months' faithful service at the quarry, are eligible for final discharge.

The men are well fed, clothed comfortably and given springs and mattresses to sleep on. In the summer they have the freedom of the stockade yard, and in winter are free to pass the long evenings in social amusements in the bunk house. It is the freedom of intercourse with each other as compared to the cell life of the penitentiary which they seem to appreciate most, and it undoubtedly has a good effect upon their work.

Steam Traction Cable Blast Hole Drills in Earth and Rock Excavation

By Albert D. Blakeslee

The first job on which C. W. Blakeslee & Sons ever used well drills for large blast holes was on Contract 25 of the new Catskill aqueduct for New York City. This contract was situated at Kitchawan, N. Y.

The machines (two Keystones), operating by steam and traction driven, were put in ahead of a Marion steam shovel—model 60—with a special long boom. This shovel was made in Marion, Ohio, by the Marion Steam Shovel Company. The cut was about twelve feet deep, the top six feet being earth, and the other six a sort of slaty rock. The cut was about twenty feet wide, and we drilled two holes twelve feet apart

rock cut of about 35,000 yards, averaging about forty feet deep, and running as deep as sixty feet at the summit.

We made a thorough cut of this, using a steam shovel to load into six-yard cars.

We used the well machines here, putting the holes about five feet below grade and putting five or six holes abreast across the face, and just shooting one row at a time, but shaking up between 1,000 and 2,000 yards of rock on each shot.

The rock here was also of a slaty formation, with lots of seams, so if we got powder into the bottom of



Forge Shop of Keystone Driller Company, Beaver Falls, Pa., manufacturers of the famous Keystone blast hole drills. Asbestosteel Sawtooth Roof Construction is shown. Permanent fireproof roofs at minimum cost have been a thing sought in building construction. Corrugated steel sheathing, covered with concrete, has been widely utilized for roofs, and the material used in the above roofs, developed by the Asbestos Protected Metal Co., Beaver Falls, Pa., is flat corrugated steel sheathing coated with natural asphalt, which is, in turn, protected by rock-fiber asbestos felt. For roof construction, this asphalt-asbestos surface protects the steel and presents a finished under surface, eliminating the necessity of plastering. Some tests were recently conducted by the company at its plant in Beaver Falls, Pa., to determine the deflection of slabs under different loadings, and to observe the manner of failure. Asbestosteel roofing is extremely strong, and as ordinarily applied will carry loads far in excess of anything met in usual practice. Actual tests made by applying a uniformly distributed load to finished slabs are shown in their catalog. A material saving in concrete is effected by this form of construction.

across it. Of course we had to use a casing for the first six feet, and for this we got some second-hand six-inch iron pipe. We were able to use each piece several times. This we found worked very satisfactorily, except for the fact that we were not allowed to drill below grade, and therefore did not always pull all of the bottom.

We found the cost for drilling about equal to the cost for steam drills, and used about the same quantity of dynamite. The machines averaged about thirty-five feet in eight hours.

Where the saying came in was that there was no stripping to be done, and this where there is six feet of covering is quite an item.

We next used well drills on a contract for double tracking on the Berkshire division of the New York, New Haven & Hudson River railroad between Hawleyville and Shelton, Conn. We had a three-track

the holes and broke the bottom the top came in very good sizes to load. In these holes we used about a box of dynamite in the bottom of the holes until we got above water, and then used from one to two cans of black powder. In the deepest holes, which were about sixty-five feet, we used fifty pounds of dynamite and fifty pounds of black powder. This, of course, was in the country and away from houses, so there was no danger from flying stones or concussion.

It would be hard to compare the actual cost with that of steam tripod drills on this cut, for had we used the latter, each time the shovel cleaned up the bottom it would have had to wait until the drills could have drilled up the bottom, the whole plant lying idle while this was being done.

In this work the drilling machines averaged about forty-five feet in a ten-hour day.

We used the well drills on several other cuts on this

piece of work, and found that, while the drilling and powder costs were about equal to those where steam tripod drills are used, the big saving was in being able to get the material loosened up ahead of the shovels.

Blakeslee & Sons are just completing a seven-mile section of the Hampden railroad just outside of Springfield, Mass., where they have moved about 500,000 yards of rock.

I have not been on that piece of work except three different times, when I went up for the day, so I am not in such close touch with it as I was with the other contracts I have just mentioned.

Here they had eight Marion shovels, one being a Model 20, one a Model 60 with special boom, four Model 60's and two Model 70's. They depended almost entirely on well drills to loosen up the rock, having between twelve and fifteen of them on the job.

The rock here was a sort of a bastard granite, and very apt to break up in large pieces, which had to be either drilled or mud-capped.

They tried some gasoline well drills here, and while they did very good service, they lacked the traction feature and therefore were awkward to move, needing either a gang of men or a horse and a set of tackles. It was also more difficult to find men who could run a gasoline engine and handle a well machine.

Where we have put well machines in cuts which we have taken out in more than one lift, we found it by far the best to put the drills in far enough ahead of the shovels so they could drill clear to the bottom on the first set-up, and not try to drill each lift separately. Where the latter was done there was always more or less trouble getting the hole started after the first lift; for the rock was more or less shattered, and it meant mucking out to hard rock.

The criticism I have heard most frequently about well machines is that they are not put onto a cut soon enough to drill to the bottom on a first set-up, and are compelled to drill in lifts in order to keep ahead of the shovels.

One thing we found was that it was economy and safer to put two exploders in each hole; for if only one was used, and was a bad one, the hole was lost, since it was practically impossible to dig out a thirty or forty-foot hole.

What surprised me most when I first saw the Keystone traction drills was their ability to move up very steep grades, and what rough places they could go into.

About eight years ago Blakeslee & Sons had a contract to drill eight-inch holes into the piers of the Hudson River bridge at Poughkeepsie, placing seven-inch iron pipe into these holes and grouting them in solid with concrete. Well machines were used for this, and proved very satisfactory, although working in cramped quarters.

1914 CEMENT MILL DIRECTORY

Will you please announce that in accordance with our usual custom we have contracted for the entire edition of the American Cement Directory, and will distribute it free of charge to every superintendent, purchasing agent and manager in the cement industry, and will also be glad to hear from such parties, outside of these, who desire a copy, writes W. A. Gibson of the Bradley Pulverizer Company, Boston, Mass.

We have received a great number of requests, but desire to see one of these little booklets in the hands of every person who is in any way connected with the purchasing of cement mill machinery and supplies.

We have gone to considerable expense in making this directory of benefit to the cement manufacturers, and believe that it will be the most complete and correct one of its kind ever issued.

A COMPLETE LINE OF POP SAFETY VALVES

It undoubtedly will be interesting to readers to learn of the many varieties of Pop Safety Valves that it is necessary for one company to manufacture if they wish to comply with different conditions of service and meet the requirements of discriminating engineers.

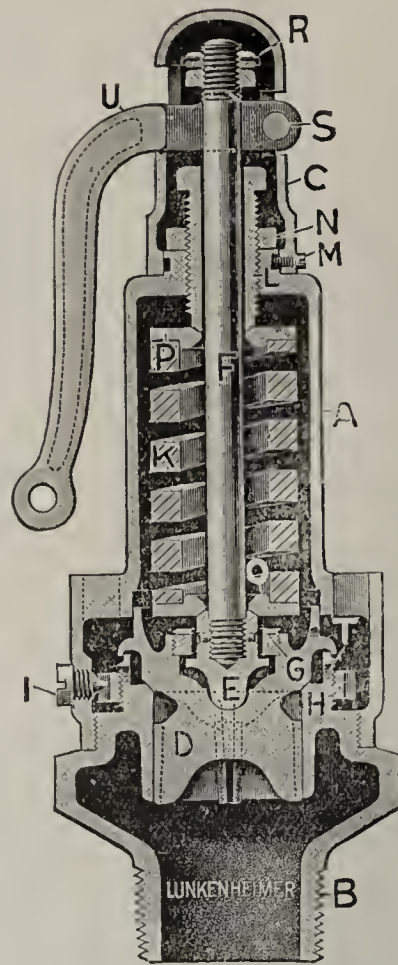


Fig. 1. "Sentinel" Bronze Top Outlet Pop Safety Valve.



Fig. 2. "Sentinel" Bronze Side Outlet Pop Safety Valve.

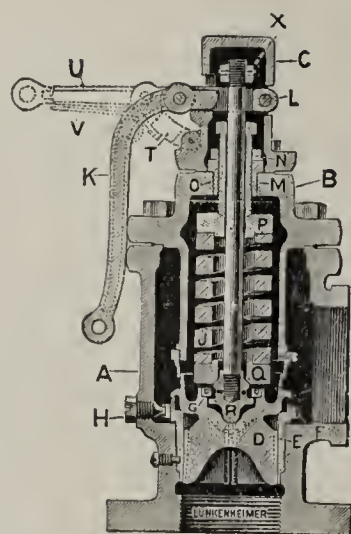


Fig. 3. "Sentinel" Iron Body Bronze Mounted Pop Safety Valve.

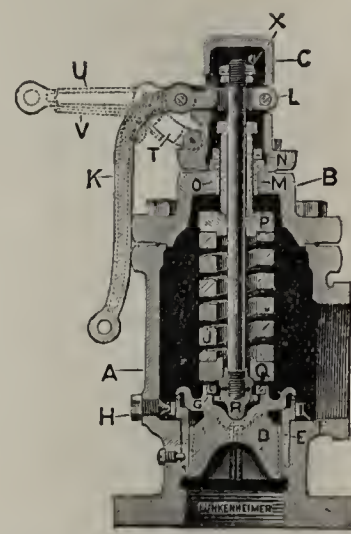


Fig. 4. Plain Pattern Iron Body Bronze Mounted Pop Safety Valve.

Space will not permit of a complete description of every design they manufacture, and we therefore confine ourselves to their principal construction, the "Sentinel," the important features of which, however, are carried out in all their different designs. Illustrations are shown of their general line, with short descriptions.

The Lunkenheimer "Sentinel" Pop Safety Valve is made either entirely of bronze, (see Fig. 1) or with iron body and bronze mounted, (Fig. 3) and as the working parts are identical, a description of one will suffice for both. Reference is therefore had to Fig. 1, which illustrates the bronze construction. When a pop valve is ordered, the purchaser, as a rule, stipulates the pressure at which he desires the valve to relieve, but after the valve is connected, certain conditions may arise that require a resetting of the valve. With the Lunkenheimer construction, it is not necessary that the entire valve be taken apart for this purpose, it being only necessary to remove the lever U,

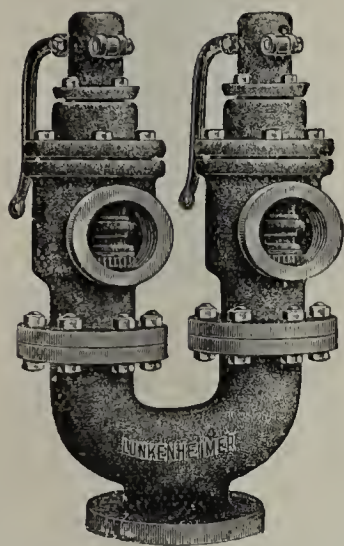


Fig. 5. "Twin" Pop Safety Valves.

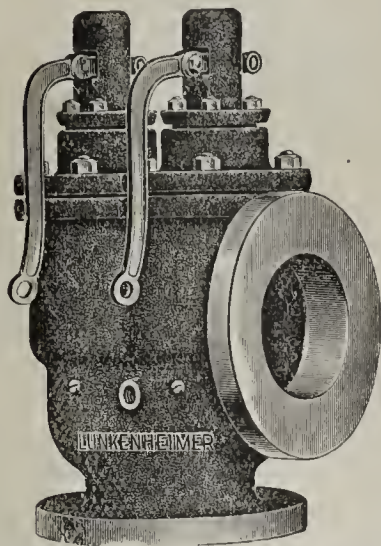


Fig. 6. "Duplex" Pop Safety Valves.

then the bonnet C, when access can be had to the regulating screw L. Should it be desired to have the valve relieve at a higher pressure than that for which it was set, the regulating screw L is turned down, placing a greater load on the spring, and for a lower pressure, it is turned up, which relieves the load.

It is usually found that after a valve has been reset, it will either relieve too much or not enough pressure. This is rectified, in the Lunkenheimer improved construction, by a regulating ring H located in the base of the valve, and which screws over an extension of the seat. The object of this ring is to cover or uncover, as the case may require, a series of holes T drilled around the extension of the seat, and by removing the set screw I and inserting a wire, the regulating ring H can be turned up or down, as desired. By turning the ring H up, covering the holes, only a small quantity of steam can escape through these holes, which places a large amount of pressure on the bottom of the disc flange or lip, giving it a higher lift and holding it longer off its seat, thereby

allowing considerable steam to escape and a proportionate amount of pressure.

This improved construction enables a very wide range in reduction of pressure,—from as low as one pound to as high as fifteen pounds, depending, of course, on the pressure carried in the boiler.

It will be noticed, by reference to cut 1, that an extension on the top of the disc G fits within the bottom of the bell A. The object of this is to thoroughly encase the spring K, thereby protecting it from the corrosive action of the steam.

The valve shown in Fig. 1 is of the top outlet pattern, but where it is desired to have the escaping steam exhaust at a distance from the valve, the angle pattern (see Fig. 2) should be used, which permits of the connection of a pipe at the side.

A comparison of Figs. 3 and 4, which illustrate iron body types, will show that the working parts are practically the same, but that the spring casing has been omitted in Fig. 4, and the spring is consequently not protected from the steam. In some cases, however, it is not considered essential that the spring be encased, hence the necessity of a design like Fig. 4, which is known as the "Plain Pattern." The use of large size pop valves is in a number of cases not only objectionable, but in some States a pop valve about five inches is prohibited. It is therefore necessary to use two smaller valves having a combined area to that of the required large size valve, and for this reason the constructions shown in Figs. 5 and 6 were designed. Fig. 5 illustrates the "Twin" Pop Valve, which merely consists of two separate valves attached to a suitable base or Y, while Fig. 6 shows the "Duplex," in which two independently operating valves are encased in one body. Both have their advantages. With the "Twin," should one of the valves become damaged beyond repair, it can be replaced with a new valve at a less cost than the "Duplex." On the other hand, space may not permit of the use of the "Twin," and consequently, the "Duplex" must be resorted to. In some cases, no objection is had to the escaping steam within the boiler room, and therefore, no pipe connection is made to the outlet. Should it be desired to have the steam exhaust at a distance from the valve, the "Duplex" would then have the advantage, inasmuch as only one pipe connection is necessary, whereas the "Twin" would require two.

Fig. 7 illustrates a type of valve generally known as the "Marine" pattern. It differs from the "Sentinel" Pop Valve, shown in Fig. 3, only in the addition of a wing handle at the top of the valve, the object of which is to conveniently enable the turning of the disc on its seat for regrinding purposes, or while the valve is under pressure, to remove slight incrustations that may lodge on the seating surfaces. An improved form of valve that is very popular is that shown in Fig. 8. In this construction, the spring is exposed, the principal advantages being that the spring is positively protected from the steam and that it is at all times accessible for inspection. This valve is particularly well adapted for use where superheated steam is used, as the extremely high temperatures cause the springs to rapidly lose their tension. The construction of the working parts is practically the same as the valve shown in Fig. 3.

For locomotive service the valve shown in Fig. 9 is generally used. It is similar to Fig. 1, with the exception that the lever for operating the valve by hand is omitted, which complies with the requirements of railroads.

To reduce the objectionable noise of the escaping steam, the valve shown in Fig. 10 is furnished. This



Fig. 7. "Marine" Pattern Pop Safety Valves.

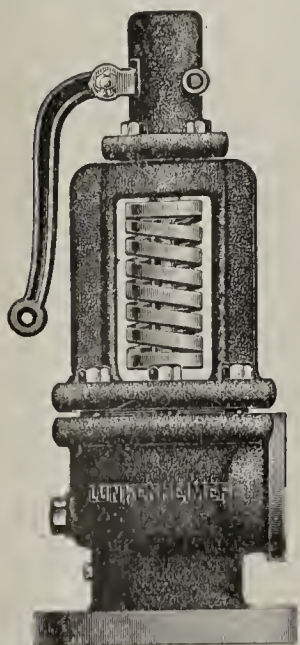


Fig. 8. Pop Safety Valve With Spring Exposed.

construction consists of a series of perforated plates through which the steam is free to pass, but as the velocity of the steam is greatly retarded by the time it reaches the top of the bell, the noise is almost entirely overcome. This valve is used to great advantage on hoisting engines, steam tractors, steam shovels and other steam generators used in exposed places or upon the highways. The "Alert" Pop Safety Valve shown in Fig. 11 was designed for use on steam boilers. It is so designed that the pressure in the boiler cannot exceed fifteen pounds per square inch, which is the maximum pressure generally carried in boilers for steam heating purposes. It is provided with a padlock to prevent tampering with the setting, but even though access was had to regulating screw J, the same could not be turned down any further than the shoulder at the top would permit, thereby preventing setting over fifteen pounds. The valve, of course, can be set to relieve at any pressure under fifteen pounds, if desired.

The form of Pop Valve shown in Fig. 12 was designed to comply with the requirements of the recently developed industry of producing gasoline from natural gas. For this purpose, a valve must be so constructed that an intermittent, reliable popping and closing action must be insured, because the degree of economy obtainable, depends largely upon the positive operation of the valve.

As this valve is subjected to severe service, the seat is made of a hard nickel composition, and the valve in general is of heavy construction. If desired, it can be had provided with handwheel, as shown in Fig. 12,

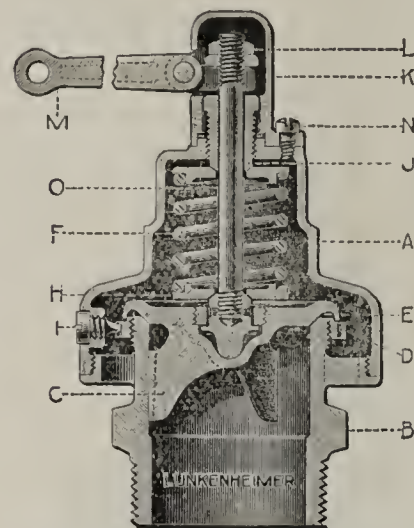


Fig. 11. "Alert" Pop Safety Valve for Steam Heating Boilers.

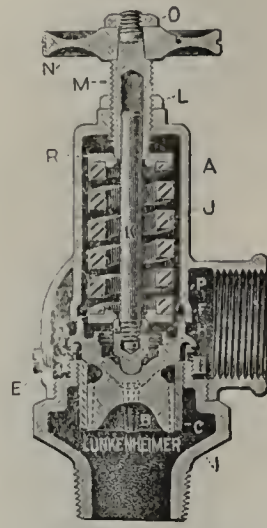


Fig. 12. Gas Pop Relief Valve.

The company maintains a rigid system of testing and inspecting, which enables them to broadly guarantee their products to be exactly as represented. They state that only the very best grade of new materials are used, the compositions being formulated in their own laboratories and contain all of the elements necessary for the greatest strength and durability.

The Lunkenheimer Company have issued a very attractive booklet, illustrating and describing in detail their complete line of Pop Safety and Relief Valves. A copy of this booklet can be had upon application.

CONCRETE BRIDGES—SUIT FOR INFRINGEMENT

A suit for infringement of patent and of copyright was filed November 8th in the United States District Court against W. S. Gaehart, State Engineer of Kansas, by Daniel B. Luten of Indianapolis. The suit charges infringement of Luten patents in a concrete bridge designed by the State Engineer for the City of Newton, Kansas, and also charges infringement of copyright by appropriation of part of Luten Standard Specifications for Concrete Bridges.

SAND AND GRAVEL NEWS

The Pioneer Sand and Gravel Company of Seattle, Wash., recently purchased from Hunter & Larson, Arcade Bldg., Seattle, Wash., local agents for the Union Steam Pump Company of Battle Creek, Mich., condensing apparatus, also some direct-connected centrifugal units. The Union Steam Pump Company is now making a complete line of direct acting electric driven pumps, a line of Volute Centrifugal pumps, a line of power driven duplex pumps, etc.

The Rockford Sand & Gravel Company, Rockford, Ill., are using a No. 5 Austin gyratory crusher for crushing their gravel; it is giving excellent results, according to Mr. Gibson, the manager of the Rockford company.

ALLEN GRAVEL COMPANY

The Allen Gravel Company, Iuka, Miss., employ a Model 61 Marion steam shovel, manufactured by the Marion Steam Shovel Company, Marion, Ohio, for digging gravel in their pit.



Fig. 9. Locomotive Pop Safety Valve.

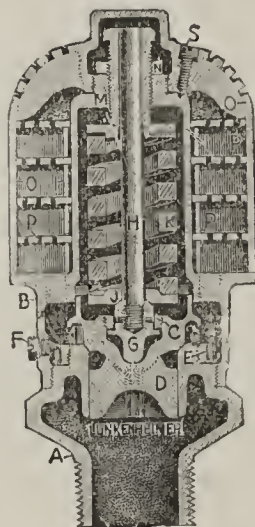


Fig. 10. Pop Safety Valve With Muffler.

to facilitate regulation of the pressure, but it can also be had provided with a plain cap at the top, similar to that shown in Fig. 9. Manufacturers of Pop Safety Valves are sometimes called upon to furnish valves made of materials other than brass or iron, such, for instance, as "Puddled" Semi-steel or Cast Steel. While the demand for other materials is very limited, nevertheless, if a manufacturer wishes to broadly cover the field, he must not only be prepared to furnish a large number of designs, but he must also be in a position to supply them made of any material called for.

The Lunkenheimer Company pride themselves upon the efficiency and reliability of their Pop Safety Valves. An inspection of the valves will show that the springs are large, are made of the best steel procurable, and rest between ball and socket plates, so that the pressure on the disc is equally divided. It will also be seen that the discs are well guided at both the top and bottom, insuring perfect seating, and the manufacturers claim that the construction is such that the valves will not chatter or pound themselves to pieces.

THE BESSER CONCRETE BLOCK MACHINE

A great advantage of a structure built of concrete blocks lies in the fact that all concrete blocks have hollow air spaces.

A solid wall is one of the best conductors of heat, and air on the contrary is one of the poorest. (All contractors and builders try to put up their buildings with air spaces in the walls.) All concrete blocks are made with hollow air spaces on the Besser machines. A wall built of Besser blocks is therefore almost impervious to heat, cold and moisture (since air is practically a non-conductor of these elements). The air space keeps the cold from passing in, conversely the heat from passing in during the hot summer months, writes the Besser Mfg. Co., 407 Thirteenth street, Alpena, Mich.

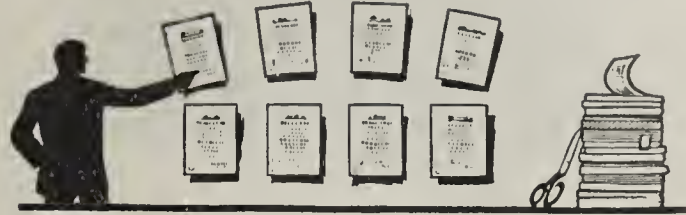


The Besser Loose Core Face Down Cement Block Machine.

The result is a cooler house in summer, and not only a warmer house in winter, but a house that costs less to heat by 25 per cent, and 25 per cent off your fuel bill means a considerable saving in the course of time.

Ventilation is another advantage of hollow block construction. A thorough circulation of air may be established through the air spaces and thus take off the noxious gases and vapor of the air. Another advantage is that the air space may be used without extra expense for all wiring, piping, etc.

The cost of building operations with blocks is cheaper than with any other material. There are no painting bills. A mason or bricklayer can lay blocks much cheaper than brick to fill the same space. With



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FINENESS DETERMINATIONS IN CEMENT

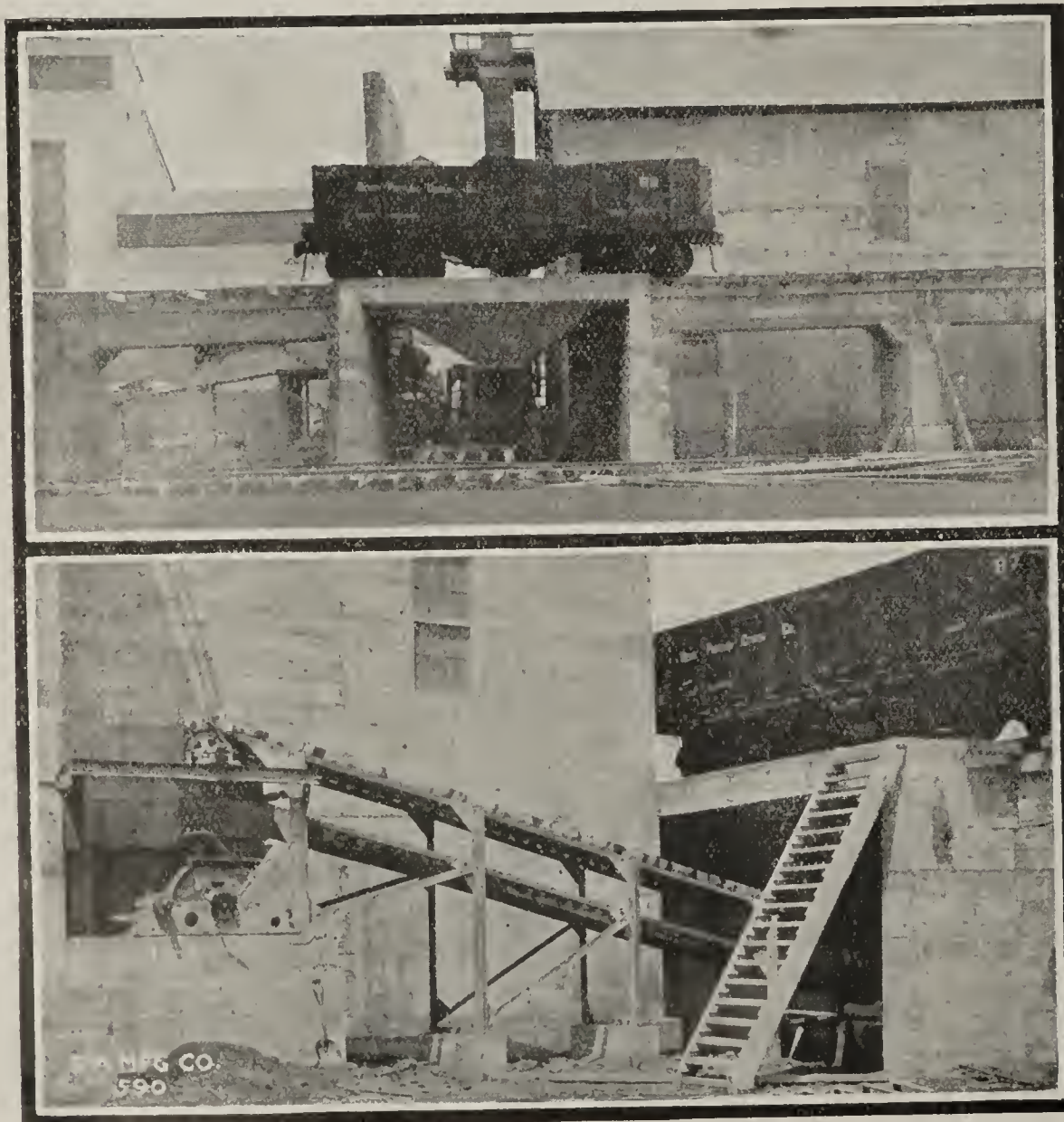
Referring to the letter of Mr. Bernard Enright, director of the Eastern Testing Laboratories, Allentown, Pa., which appeared in the October issue of Cement & Engineering News, will say the determination of the proportion of a Portland cement which will pass through a standard 200-mesh sieve is at best only a makeshift test for the effective fineness of a cement. It is probably true that the larger particles of cement which will just pass a standard 200-mesh sieve are of about as little value as a cementing material as those which remain on the sieve. If we could have a 500-mesh sieve we might, perhaps, by means of it determine the percentage of active material in a cement. But as we have no wire screens finer than 200-mesh, and as the sieve test has become so well established as one of the customary tests for acceptance of a cement, it is highly desirable that the

test be developed to its highest attainable state of perfection and its use continued until we have a better and truer method of determining the amount of highly active particles in a given sample.

The present method of having the Bureau of Standards caliper the wire and count the meshes of a sieve leaves the question of the uniformity of size of the meshes still an open one. To measure the size of the openings directly would be an endless task and probably out of the question. The proposal that a comparison of sieves be made by passing a sample of finely ground material, either cement or something else, through them has received serious consideration both by the Bureau of Standards and others interested in the subject. It would seem possible to so compare the results obtained with two or more sieves, after check tests had been made with them on a standard sample, that a certificate of accuracy might be issued by the bureau. There appears to be small ground for objection to the use of a correction factor for such sieves as did not quite agree with the standard sieve. All such standardizing or calibrating tests should, however, be made by the Bureau of Standards and not by individuals or by commercial laboratories.

Another possible method of testing a sieve for accuracy of mesh and uniformity of opening would be to project the sieve by means of a lantern on a large screen, previously marked off as a perfect sieve would appear if projected on to it, and noting the variation between the projection of the sieve being tested and the theoretically perfect sieve marked on the screen. By this means the variation in the count in both directions would be at once revealed by interference, as would also the variation in the size of the openings.

As no screen cloth is perfect, all would fail to a greater or less degree when subjected to a test of this kind. It would be possible, however, to determine the degree of variation of a sample from the ideal screen cloth and to specify limits of allowable variation.



VIEWS OF THE
COAL HANDLING
PLANT
AT THE
DEWEY PORTLAND
CEMENT COMPANY'S
PLANT
AT DEWEY, OKLA.

Among The Cement Mills

It would also be possible by such a method to select a piece of cloth as nearly perfect as could be obtained to serve as a standard for the comparison of other sieves by some such method as that described in the letter from Mr. Enright.

Undoubtedly greater accuracy is needed in our fineness test for cement. Ultimately we will probably have a practical test which will indicate the percentage of particles very much finer than those which will just pass the present standard 200-mesh sieve. Until that time arrives an effort should be made to improve the present test. The method of standardizing or calibrating by means of a standard sieve and a standard sample of fine material, if handled by an experienced disinterested operator, should tend to greater accuracy.

CLOYD M. CHAPMAN,

Engineer of Tests, Westinghouse Church Kerr & Co.
New York City.

CONCRETE WATER TANK

A contract has been awarded J. G. Berger, general contractor, Fort Branch, Ind., by W. A. VanFrank, division engineer C. & E. I. R. R., Danville, Ill., for the construction of a 30,000 gallon re-enforced concrete water tank, the base to be sixteen feet above top of rail, engine and pump under tank. This tank is being built at LaCrosse, Ind., near the junction of the Pennsylvania, C. & O. of Indiana, Monon, Pere Marquette and C. & E. I. R. R.

METHODS OF DETERMINING THE FINENESS OF CEMENT.

I have read with interest the article headed, "Fineness Determination in Cement," in your October issue by Bernard Enright, director Eastern Testing Laboratories, Allentown, Pa. This is a subject that I have given a great deal of thought during the past few years and one that seems to me is deserving of thought, as certainly the methods of determining the fineness of cement or, in fact, of any other material, such as ores, fertilizer, rock, etc., are very crude, writes W. J. Bell, president Newaygo Engineering Company, Newaygo, Mich., and formerly superintendent of the Newaygo Portland Cement Company. In other words, there is only one element entering into the determination of the fineness that is standardized at all, and that is the sieve itself, and surely nothing like uniform results can be obtained by the use of a standard sieve under one hundred different conditions and in the hands of one hundred different testers—the personal element enters into the determination to such a large extent that nothing like uniform results can be obtained. I have personally taken samples of cement and made a series of ten tests, each one a duplicate of the other, just as near as I could make it a duplicate, using, of course, the same sieve and the same sample, and in no case have I been able to duplicate a result, that is, all ten results were different, and the difference amounting to a considerable percentage. This, of course, is all wrong, and I have

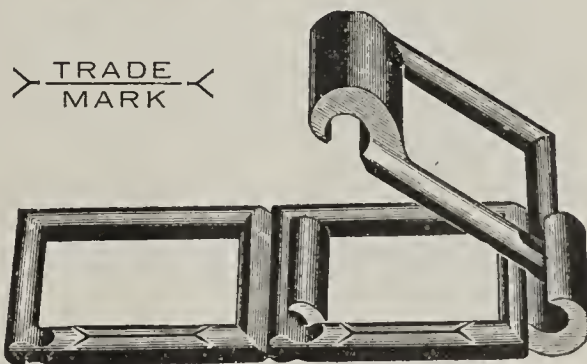
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often wondered why more attention has not been paid by engineers to this matter of determining fineness. In my long experience in the manufacture of Portland cement I have often thought that the irregular results obtained in making fineness tests on the raw material in the ordinary cement plant laboratory, has had as much to do with the trouble in producing a chemically uniform finished product as anything else. Therefore, during the past two or three years I have been working out a plan for correcting this faulty determination, which is in this way—I have been developing a machine to do the testing mechanically, using our present standardized circular sieves, as made by the W. S. Tyler Company, and believe that I now have this worked out. We have built and operated a model of the machine and in a series of tests made the other day here at Newaygo, with Mr. Curtiss of the W. S. Tyler Company, we obtained very satisfactory results and were able to duplicate a determination almost exactly, using the same sample, which is impossible to do by hand testing. While I am not able to furnish you a photograph of the machine just yet, I would advise that it consists of a machine, the general dimensions of which will be about 32 inches long by 18 inches wide by about 24 inches high, weighing probably 175 pounds. Any standard testing sieve from 6 to 8 inches in diameter can be used in the machine, and from 1 to 8 sieves can be used at the same time, or rather, a range of determinations obtained in one operation. The machine will be fitted with a clock and automatic cut-off so that an operator will be able to put his sample in the machine, go about his other work and return to the machine whenever convenient, taking out and weighing his samples. The automatic cut-off will be, of course, adjustable so that the operator can set the machine to run from one, two, three, five or ten minutes, as he wishes. This machine will be sold by the W. S. Tyler Company and the Sturtevant Mill Company, Boston, Mass. The W. S. Tyler Company are assisting in the development of the machine, and will be the general sales agents. I believe that we have solved the problem, which you were discussing in the page of your paper which came to hand this morning and noting this article, induced me to write you in reference to the machine. I had not planned to call your attention to this machine until a somewhat later date. In the course of a few weeks we will be able to furnish you photographs and more detailed information, if you are interested in having the same. As stated above, it is my belief that this machine will solve the problem absolutely, and enable engineers to obtain absolutely uniform fineness tests, and do it with a large saving of labor and time. The writer has given this, as mentioned, very careful thought during the past two or three years and has been very careful in working out the design of the machine, and feels sure that it will meet with the approval of the engineers generally.

CEMENT IN SINGAPORE

Cement is being imported here in increased quantities each year, as buildings are more numerous and there is no doubt but that its importation will continue to be of greater importance, writes Edwin S. Cunningham, American consul general, Singapore, S. S. In 1911 there was imported 383,895 casks of cement valued at S. S. \$1,538,898 (\$873,631) and in 1912 the importations had increased to 463,276 casks valued at S. S. \$1,941,225 (\$1,102,031). Of the total importations practically one-third was re-exported to the Malay Peninsula and islands of the Malay Archipelago.

At the present time the United States supplies only a very small quantity of cement. In 1912 the United

Kingdom supplied 162,857 casks, Hongkong 195,975, Denmark 76,018, while Belgium, Austria Hungary, Germany, France, Japan and the West Coast of Sumatra supplied this article in smaller quantities. During the recent months Japan has been making a very vigorous effort to obtain a larger share of this trade and it is anticipated that she will be more or less successful.

At the present time the Chamber of Commerce quotes cement at S. S. \$3 (\$1.70) to \$.50 (\$2.57) per barrel.

SAND-LIME BRICK

In addition to making a high grade face brick, by the sand and lime process, the Sacramento (Cal.) Sandstone Brick Company carries a line of artificial sandstone, pressed into moulds for band courses, sills, lintels and quoins. This material is called "Artstone" and is made in light grey, buff, brown, slate and, where wanted, red. This "artstone" has the appearance of real stone, and is equal in quality to the best sand stone, standing a crushing strain of 3,000 to 6,000 pounds and, as it can be cut like natural stone, it is extensively used on the Pacific Coast, for trimming purposes. This company's brick ranks with the best produced in this country, and many of Sacramento's finest buildings are faced with it. At the present time, nearly every building under construction in that city, which has a brick exterior, is using the Sacramento Sand Stone Brick Company's product in its facing. Among other work which this company has handled recently, are the following buildings: The First Methodist Church in Oakland, Cal., now building; St. Alban's apartments in San Francisco, Cal., recently finished; Highson Hotel, Modesto, Cal., a six-story structure, now building; Murray & Jones Mercantile Block at Modesto, Cal., recently completed; Quincy (Cal.) High School, now building; Travellers' Hotel, Sacramento, Cal., a seven-story building in course of construction; Sutter Hotel (seven stories) Sacramento, Cal., now building; Merrium apartments, Howe apartments, Shaw-Batcher building, Cadillac garage, Lauppe apartments and the five story building of the Sacramento Warehouse Company. In a recent issue of the Sacramento "Star" a description was given of a new 20-story skyscraper for which a permit had been asked. A part of the specifications are for Sacramento Sand Stone Brick, so it will be seen that this company is "in" on the big work, while taking good care of the smaller trade—the five and six story fellows.

WOLVERINE PORTLAND CEMENT

The Wolverine Portland Cement Company of Coldwater, Mich., has had a prosperous year, after several very lean ones. The company's production has been large and it has realized about 20 cents a barrel over the price which prevailed last year. The company's earnings for 1913 are estimated at \$100,000, or 10 per cent on its capital of \$1,000,000. The greater part of the earnings will be put back into the plant, however. With another year like the present all of the improvements planned will have been completed and the company will be in position to resume dividend payments. Its plans are being brought up to the highest state of efficiency and these improvements will enable the company to cut the cost of manufacturing very considerably, and the stockholders will eventually reap the profit. The modern rotaries to be installed will save at least 10 cents a barrel on the cost of production. Devices for handling the clinkers and automatically packing the cement, and new grinding machinery will lop off a few more cents per barrel.

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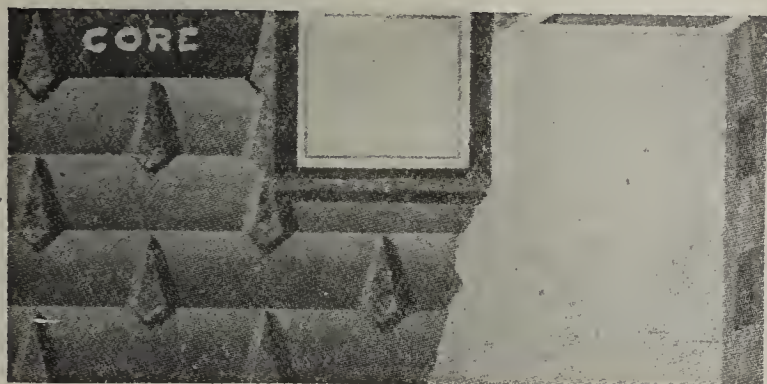
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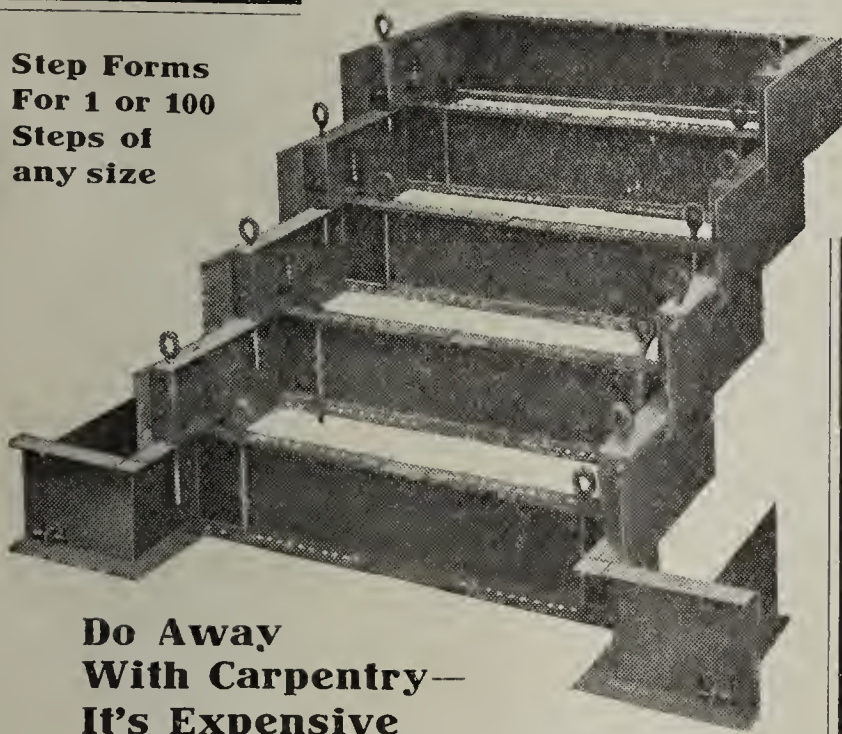
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Houses, impervious to heat, cold and moisture, at low cost, can be built with Redman forms. Adapted to any style of architecture. Approved by several government engineers.

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Adjustable to all sizes, enabling you to use the same forms on hundreds of different sized jobs. They are complete in themselves, not simply form holders, but a complete set of molds for molding concrete steps.

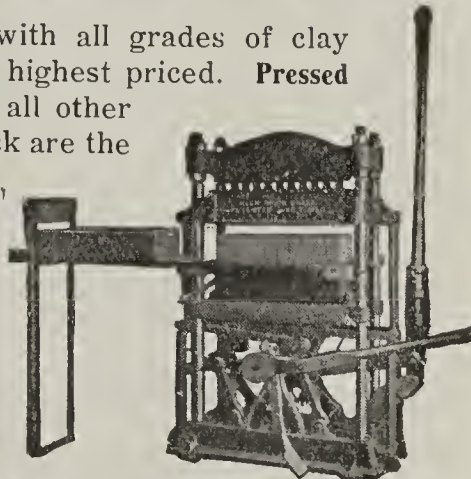
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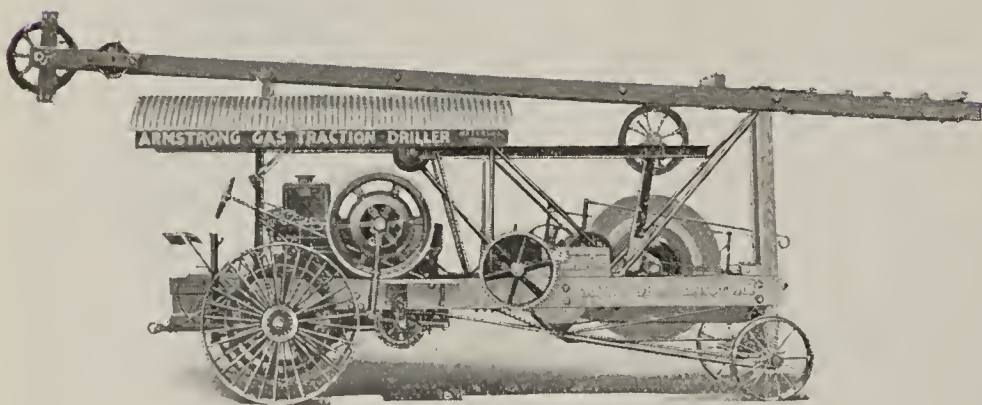
PORTABLE WAGON LOADER

The Link-Belt Company, Chicago and Philadelphia have recently placed upon the market a portable wagon loader which loads 40 yards of material (sand, stone, gravel, earth) per hour—or a ton of loose material (anthracite or bituminous coal) a minute. Wagons or trucks need never be kept waiting for a load. The problem of applying machinery to successfully loading materials has been solved by the construction of the Portable Wagon Loader in which a steel framework, mounted on wheels, supports a strong bucket elevator, in such a manner that the foot of the elevator can be pushed right into the base of a pile of material, and the head arranged with suitable discharge spout to deliver material directly into wagons or trucks; or into a screen for separation of sizes before delivery into the wagon, if desired. The elevator is driven by a 5 H. P. motor, electric or gasoline as required, mounted on the same general framework, and the size of buckets and continuous operation furnish a capacity of 60 tons of coal, or 40 yards of broken stone per hour, thus enabling a crew of two or three men to do work which would require at least ten men with shovels. A clear saving of five to ten cents per ton can easily be made in handling materials in any large quantities. Prices, blueprints and all necessary information will be mailed, free of charge, on request. Mention Cement & Engineering News when writing.

A SPECIAL BLAST HOLE DRILL

In quarry operation, the drilling of the rock to keep the steam shovels and crushers busy, has always been a problem. For many years the cable drills used for blast hole drilling were not designed particularly for this purpose. Recently, however, a drill has appeared which has been designed with especial reference to blast hole work, in contradistinction to water well work. This drill is manufactured by the Armstrong Mfg. Company of Waterloo, Iowa.

One who is familiar with cable drills knows that in the past the proper motion of a drill was supposed to have been elliptical. In other words, the tool should rise slowly and drop quickly. This principle has been at the back of most drills in the past. The Armstrong is built on a different principle, namely, "quicker the tools can be raised the greater the num-



Armstrong Kerosene Traction Driller.

ber of strokes per minute." In other words, any machine which does not raise the tools as fast as the laws of gravity will permit them to drop, is uneconomical of time. This is accomplished in the Armstrong by a special motion, and which furthermore, is claimed to reduce the whip of the rope and consequently the wear and tear.

Many other features of the drill are unique, for instance, the band wheel instead of being set to one side or up on the trestle work, is placed down between the two long sills, which is said to reduce strain and increase the strength of the machine. The gasoline

engine is especially designed for this purpose and manufactured in their own factory.

We illustrate, herewith, an Armstrong blast hole drill used by the Casparis Stone Company of Columbus, Ohio, in their quarry at Fairmount, Ill. For a continuous period of 139 days, it averaged 76.6 feet per day, the average fuel consumption amounting approximately seven gallons of gasoline per day. We give a few of the records made by the machine.



View of Armstrong Blast Hole Drill in Operation in the Quarry of the Casparis Stone Company.

One hundred and thirteen feet solid limestone in eleven hours on five gallons, moving and setting machine eight times; 329 feet in three consecutive days on twenty gallons of gasoline, moving and setting machine twenty-four times, giving an average of 109.66 feet per day; 574 feet in six consecutive days on thirty-eight gallons of gasoline moving and setting forty times, giving an average of 95.66 feet per day, during these six days there was a delay of three hours and forty-five minutes in turning the machine around at the end of the ledge and repairing broken inlet valve on engine, the last day of drilling was in raveling rock; 2,255 feet in 28 consecutive days, an average of 80.6 feet per day, or an average of 7.32 feet per hour for 3.08 consecutive hours; 3,885 feet in fifty-three consecutive days, an average of 73.3 feet per day or 6.66 feet per hour for 583 consecutive hours; average fuel consumption per day of fifty-three days, seven gallons.

The above records are figured on eleven hours of operation per day and there is no account taken of delays for moving or any other causes.

The manufacturers claim that from the first of December, 1912, to the first of March, 1913, the Armstrong machine drilled 53% more holes than the average of the six competing machines, which seems to substantiate the correctness of this new theory.

CEMENT SEWER PIPE

The Utah Concrete Company, 815 McIntyre Building, Salt Lake City, Utah, plans to establish a plant on a site of five acres at Brigham City, Utah, on the Oregon Short Line Railroad, for the manufacture of concrete sewer, irrigation and drain tile. Nelphi L. Morris is president and general manager.

CEMENT

... AND ...

ENGINEERING NEWS



CONCRETE DRINKING TANK ON THE ELMENDORF FARM, LEXINGTON, KY., OWNED BY J. B. HAGGIN. 117 OF THESE TANKS WERE BUILT ON THIS FARM (WHICH CONTAINS OVER 9,000 ACRES) BY THE HURST CONCRETE SILO CO., 829 EXCHANGE AVENUE, CHICAGO.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year, or two
years for \$1.50. All other countries, \$1.50 per year

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JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, FEBRUARY, 1914

IMPROVEMENT IN CEMENT TESTING NOTICEABLE

We observe with a great deal of satisfaction that engineers and consumers of cement begin to make their selection from the various brands of Portland cement on the market in a more modern and scientific manner than heretofore. It is a frequent occurrence nowadays to see specifications give the preference to cements of the highest sand carrying capacity, a method which we have advocated for years. It took a long time to overcome the old-time specifications which required that cement when tested neat, must show a certain increase in strength from 7 to 28 days. On account of this rule, the best cements that the country produced have, in many instances, been rejected for the last decade, merely because the cement, when tested neat, did not show a certain specified increase in strength from 7 to 28 days, although the rejected cement had after 7 days a strength far in excess of the strength which the accepted cement obtained after 28 days or even after 3 months or a year.

In the earlier days of the cement industry, when fine grinding was the exception rather than the rule, this coarsely ground cement would not take on strength as rapidly as at present when fine grinding is in vogue. In England some of the cement mills still believe in coarse grinding, in order to produce slow hardening; however, in this country fine grinding is demanded. Yet, to call for fine grinding in one part of a specification and for slow hardening in another part of the same specifications is inconsistent with the hardening process of Portland cement.

Through the efforts of leading cement experts who

occupy commanding positions in the industry, and whose influence is being brought to bear on cement manufacturers, associations and consumers, we are bound to see the neat cement tests abolished, since these tests throw no light upon the behavior of cement in a mortar. Then only mortar mixtures in the proportions of 1 cement to 3 sand and 1 cement to 5 sand will be tolerated. Moreover, these tests will not be considered as decisive, but compression strength tests on at least 3-inch cubes in the case of sand mortars and 6-inch cubes in the case of concrete will be demanded for all purposes, for which a clear insight is desired into the working of the material in actual construction. The reasons for the adoption of these tests are many and are frequently being discussed in American technical journals.

This has been the method of valuation for cement in Europe for the last fifteen years and should become an international standard rule.

In this country we are still far from adopting compression strength tests. However, improvement in testing cement and selecting it according to its real value becomes more and more noticeable and antiquated methods are gradually being abandoned.

CONCRETE SILO EVERLASTING

"The silo is no longer an experiment," says Dr. M. E. Conard of Chester county, Pa. "No dairy farm is complete without one. It is just as important that it be properly located and constructed as any building on the farm, and that it be made durable and of long life. The time has passed when a silo should be built of material that will only last about 10 years or less.

"A concrete silo can be built for a little more cost than most other kinds, but if the materials are of the proper kind and thoroughly mixed and reinforced with iron it will be practically everlasting. Such a silo can be made to serve a second purpose—that of a tower for a water tank. When the silo is as high as is needed, put a reinforced top on it, then extend the side walls about four or five feet higher and you have a better and cheaper water tank than you can get in any other way. You have the two structures on one foundation, one roof, in one-half the space, a better elevation, wind proof, close to the barn and giving good fire protection."

CONCRETE HIGHWAYS

Citizens of New Carlisle, Ind., have just voted unanimously for the construction of twelve miles of concrete highway. The Universal Portland Cement Co., is to write the specifications and the roadway will be nine feet wide with three-foot gravel shoulders. This work came as the result of an inspection of the concrete roads at Buchanan, Mich.

Bids were opened recently for 30,000 yards of concrete pavement to be placed at South Bend, Ind. This is the first installment on more extensive work of the same kind contemplated for the summer.

CONCRETE ELEVATOR

J. G. Berger, General Contractor, Ft. Branch, Indiana, has been awarded a contract for the construction of a reinforced concrete wheat elevator consisting of a battery of eight tanks, by the Ziliak & Schafer Milling Co., Haubstadt, Indiana.

Olympic Cement Plant: Bellingham, Washington

Construction of the Portland cement plant of the Olympic Portland Cement Company at Bellingham, Washington, began after the plans and under the direction of F. L. Smidth & Company, James C. Muir in charge, in October, 1911. The first clinker fell from the big kilns on May 12, 1913, and the first shipment of cement was made to Galbraith, Bacon & Company, Seattle, on June 1, 1913.

The history of this plant dates back for many years and has its origin in the large limestone deposits of the Washington cement belt at Kendall, on the old Bellingham Bay & British Columbia railroad, now the Bellingham & Northern since the line was purchased by the Chicago, Milwaukee & St. Paul. A thorough exploitation was made of this deposit and a small test kiln, of the Schofer type, was erected at Bellingham about 1903. The origin of the clay used in this preliminary work is not known to the writer, but probably came from one of the many excellent deposits of glacial clay near the city. Early plans for the erection of a plant contemplated a location at the limestone deposits near Kendall, but this location was, however, later abandoned for a more excellent one on tide water, Bellingham bay, and with competing rail transportation.

The Raw Materials

The raw materials consist of a highly crystalline limestone, a glacial clay, gypsum and water. The limestone deposits cover an area of 1,000 acres at Balfour, Washington, 32 miles east of Bellingham, on the Bellingham & Northern railway. The following analysis of the stone indicates its high quality for the manufacture of Portland cement:

Average Analysis of Limestone

Components—	Per Cent.
Silica	2.00
Iron and alumina.....	0.66
Magnesia	0.45
Calcium carbonate	96.04

It will be noted from this that the stone is very high in the carbonate of lime and very low in magnesia. The stone belongs to the same geological formation which extends from the Rocky mountains westward through Vancouver islands. The limestones of this formation are uniformly rich in lime and poor in magnesia, and for many years have been productive of the finest lime on the market. Since the rapidly increasing demand for Portland cement these deposits have been eagerly sought under favorable conditions and in accessible localities. At Balfour they form veritable mountains, while at other places they are found in ledges, overflows and pockets.

The clay deposits cover an area of 160 acres at Brennan, Washington, seven miles north of the plant, on the Great Northern railroad. The exact volume of clay is not known but has been tested at several points to determine that the supply is abundant. This clay was at one time used in manufacture of brick. The true value of this clay for cement purposes is best shown by the analysis made, as follows:

Average Analysis of Clay

Components—	Per Cent.
Silica	58.20
Alumina	18.17
Iron oxide	6.95
Lime	3.47
Magnesia	3.28
Loss by ignition.....	6.00
Balance undetermined.	

The gypsum used is mined at Gypsum, Chichagof island, Alaska, and delivered to the cement plant by the Pacific Coast Gypsum Company, Tacoma. This is a high grade product containing about 77 per cent calcium sulphate and about 22 per cent water.

Water, of course, is used more or less for one purpose or another about every manufacturing plant, but it is here mentioned as one of the principal raw materials because it is an essential element in preparing the raw materials for the kilns. As a wet-process plant the water used in the manufacturing alone amounts to one-half of the weight of the combined dry raw materials. This means a daily consumption of water, which is obtained from springs near the bay shore on the site of the plant and raised by a motor driven turbine pump of 175 gallons per minute to a 40,000-gallon capacity tank on the water tower, giving a gravity flow to all parts of the works.

Mill Site and Buildings

The site of the plant comprises 60 acres on the level bench overlooking Bellingham bay and lying one mile north of the city limits. It is easily reached from the city over the Eldridge avenue car line to its terminus, thence a mile along the highway. The Great Northern and the Bellingham & Northern have spurs only into the yards and have made no provisions for handling passenger traffic. Besides being on these railroads the site has a 3,000-foot wharf reaching out to deep water in the bay. There are about three miles of trackage in the yards of the company and making connections with the main line of the above mentioned railroads.

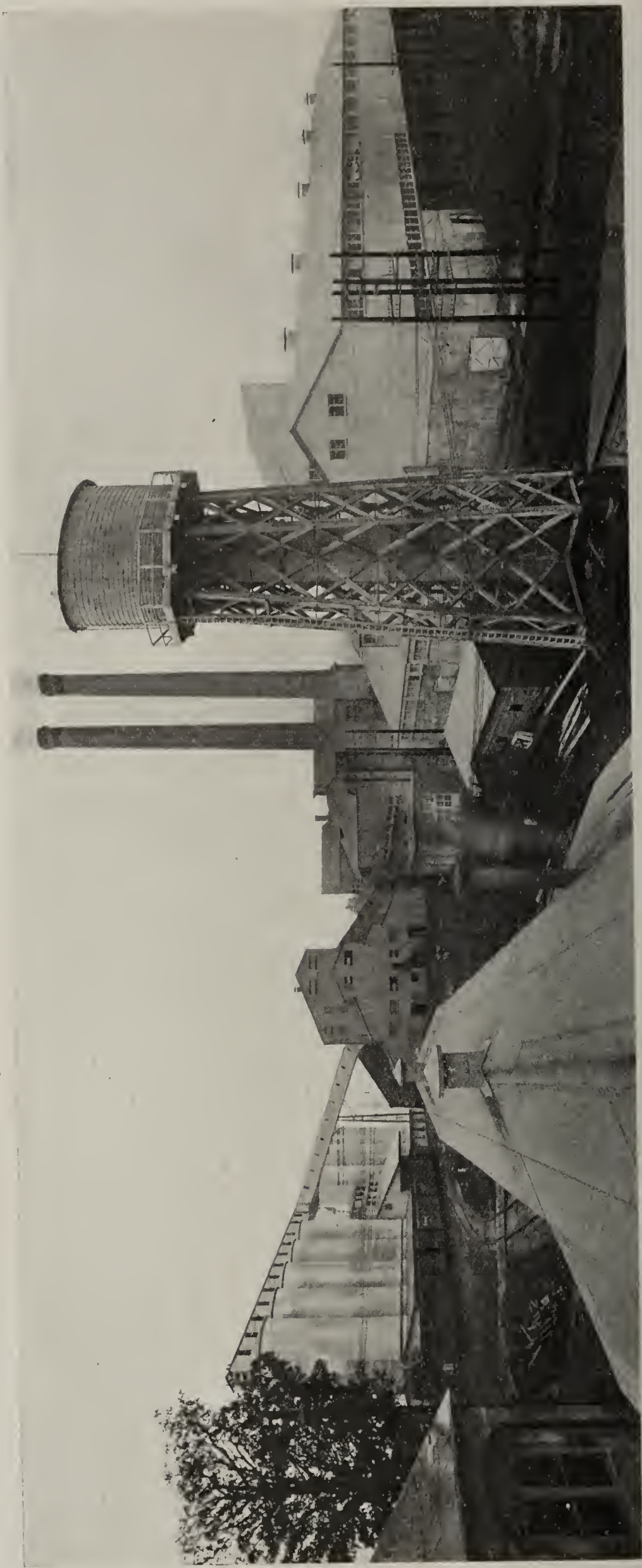
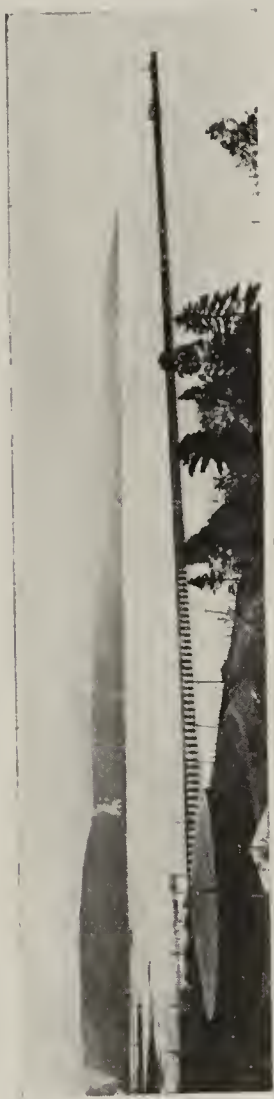
Buildings connected with the plant and located on the manufacturing site are: Office, 40x40; store-room and machine shops, 140x50; locomotive house and garage, 43x35; oil house, 64x15; switch house, 22x36; carpenter shop, 60x30; stone storage, 195x68; clay storage, 60x244; raw mill, 145x50; kiln building, 236x50; clinker mill, 45x96; cement storage and packing, 230x50. All these buildings are of structural steel or reinforced concrete construction with concrete foundations and floors, excepting the carpenter shop and water tower which are of frame.

Handling of Raw Materials

The limestone deposits are worked by the open quarry method and have now exposed a 250-foot face. The rock is worked with compressed air quarry drills. The broken stone is picked up by a 60-ton Marion steam shovel, manufactured by the Marion Steam Shovel Co., Marion, Ohio, and discharged into quarry cars, which deliver direct to a 600-ton Fairmont roll jaw crusher for preliminary breaking to 5-inch cube size. From the Fairmont the 5-inch and under sizes pass by gravity to a No. 6 Williams jumbo crusher which breaks to pass a 3-inch ring. The Williams Crusher is manufactured by the Williams Patent Crusher & Pulverizer Co., Chicago and St. Louis.

The stone is now ready for transportation to the cement mill. It is carried from the Williams mill by a 300-foot belt conveyor to the rock storage bin of 1,000 tons capacity. The bin is located above the track level and by side discharge delivers the stone into 50-ton hopper bottom steel dump cars, of which there are 32 in service. The Bellingham & Northern hauls the cement company's cars over its own line and places them in the yards of the cement mill for spotting by the cement company's Vulcan switching engine, manufactured by Vulcan Iron Works, Wilkes Barre, Pa.

There are now 50 men employed at Balfour and the



THE OLYMPIC PORTLAND CEMENT PLANT RECENTLY BUILT AT BELLINGHAM, WASH.

Designed and Built by F. L. Smidth & Co., New York, N. Y. Marion Steam Shovels, Link-Belt Bucket Elevator, Vulcan Rotary Kilns, Vulcan Locomotives. Smidth Kominuters, Smidth Tube Mills and Schierens Duxbak Leather Belting Used in This Plant.

quarry, half on rock work and half on construction. F. E. Ristine is quarry foreman.

From the mill yard the carloads of limestone are run up on a trestle and into the rock storage building and dumped direct upon a concrete floor at grade level and here storage is provided for 9,000 tons. Through a rectangular opening in this floor the limestone feeds by gravity to a 20-inch canvass belt which discharges to the boot of an inclined Link-Belt bucket elevator and this in turn to another 20-inch canvass belt conveyor which delivers the stone into a 2-way distributor which leads into either one or both of the two storage bins over the two No. 85 Smidth kominuters, a type of ball grinders. From the bins the rock passes into the kominuters under control of rocker feeders.

A spur from the Great Northern runs out from Brennan a short distance to the clay deposit, the surface of which is practically level, and on this track a locomotive crane, 17 tons capacity at 10-foot radius, is excavating the clay with an orange peel dipper from a rectangular pit and now about 1,000 feet long parallel to the track. The dipper dumps directly upon G. N. flat cars which the railroad switches over its own tracks into the yard of the cement company at Bellingham, 7 miles distant.

The cars with clay are spotted under cover and at the east end of the clay storage room. An electrically driven overhead traveling crane, with clam shell bucket attached, takes the clay directly from the cars and discharges either upon the floor of the storage room, which has a capacity of 7,000 tons, or into the wash mill as operating conditions demand.

Handling of the water has been sufficiently covered in a paragraph under the subject of raw materials.

The gypsum is received in carload lots, sacked, and stored on the first floor of the clinker mill building. It is there passed, if necessary, through a small crusher or discharged into the boot of a bucket elevator and lifted to the charging floor.

Fuel oil, which may properly be classed as one of the raw materials, being used exclusively for firing the kilns, generating steam, etc., is received direct from California in full cargo lots by tank steamers of 25,000 barrels capacity. At the end of the wharf a steam driven oil pump with 8-inch discharge is installed, and this lifts the oil from the tanks of the steamer to the company's steel oil storage tanks, 55,000 barrels capacity, on the plant site.

From the storage tanks two oil pumps are used to raise the oil to a 20,000 gallon tank behind the kilns. Two electrically driven plunger pumps, one only being required at a time, draw the oil off from the latter and forces it through the oil heater which it leaves at a temperature of 185 degrees F., ready for the kilns. Present practice consumes $9\frac{1}{2}$ gallons of oil per barrel of burned clinker.

Process of Manufacture and Machinery

With the limestone ready to pass through the rocker feeder into the kominuters and the clay in the clam shell bucket ready for discharge into the Smidth wash mill the wet-process, new to the mills of the Greater Northwest and the Pacific Coast, and in this plant possessing a number of special features, is ready to start in the manufacture of Portland Cement.

The clay is dumped into the wash mill, a large concrete cylinder, 6x25 feet containing, mounted on a vertical shaft at the center, a motor driven mixer or agitator which whips the clay, after the water has been admitted, into a thick cream, or "slurry" as it is technically called, which is from 50 to 55 per cent

water. The washer has a capacity of 30 tons of dry clay per hour.

The slurry, by a wave or splash action created by the revolving agitator, is washed through a vertical grate into a sump, or storage basin, 100 tons capacity dry clay, from which one of the slurry pumps lifts it to the clay feeders just preceding the kominuters.

The clay feeder is one of the novel and interesting machines of the mill. The slurry is a variable component of the raw mix while the limestone remains at a constant; both enter the kominuters for the first stage of grinding at practically the same time. The mechanism of the slurry feeder maintains the slurry at a constant height and continuously moving thus insuring uniformity of feed and uniformity of composition of mix. At this clay feeder the first check on the process is had, this being to determine the quantity of clay required for the raw mix. To provide for the increased demand made by the limestone upon the slurry as a liquid vehicle, the requisite amount of water is added to the kominuters with the slurry, thus securing at once a good mix.

From the kominuters the slurry is raised by a chain bucket elevator to a Trix screening machine which corresponds, in a measure, to the separators of the dry-process. The Trix produces an undersize, or heads, and an oversize, or tailings; the heads will pass 60 per cent through No. 100 screen and 95 per cent through a No. 20 screen, and continue on through the wet-process while the tailings are conveyed back to pass again through the kominuters.

The undersize from the kominuters is called the "tube mill feed." This feed is carried forward by a screw conveyor operating in an iron trough with a tight and flat cover. The conveyor discharges into a 2-compartment storage bin over the tube mills; each bin being equipped with an agitator.

The tube mills, which accomplish the second stage, or final grinding of the raw mix, are three in number: One standard No. 20 Smidth, 22 feet long by 7 feet in diameter, and containing 36,000 pounds of native Bellingham bay beach pebbles; two short No. 18 Smidth's, 10 feet long by 6 feet in diameter, and each containing 34,000 pounds of cylpebs. The No. 20 is used for the first step of the final grinding and one of the short 18's produces the finished or fine slurry containing $33\frac{1}{2}$ per cent water and passing 92 per cent through No. 200 sieve and 98.5 per cent through a No. 100.

The storage discharge immediately preceding the tube mills is arranged to take care of any combination of tube mills. If the slurry passes through No. 20 first it will be conveyed back to the second compartment of the bin and thence through either one or both of the short No. 18's. Once through a No. 18 the fine slurry is ready for the second and last check in the raw mix before it is pronounced satisfactory to pass into the big kilns and be converted into Portland cement.

From the tube mills a screw conveyor, similar to the one preceding the mills, takes the fine slurry to one of three correcting basins, each having a capacity for raw mix equivalent to 230 barrels of the finished product. When one basin is full it is immediately sampled and the component parts determined; if it is too rich or poor in clay, the clay feeder before the kominuters is adjusted to balance properly the mix in the first basin, and when both basins are full they are drawn off together into a larger basin of 1,200 barrels capacity. All of these basins, which contain slurry in any of its various stages, from kominuters to kilns,

are provided with agitating apparatus. The character of these agitators depends upon the importance of uniformity required in each case.

From the basins containing the corrected slurry, the mix is raised by compressed air to storage basins under the kilns, each basin having a capacity for 2,000 barrels. A duplicate installation of F. L. Smidth's slurry pumps is now used as required to lift the slurry to a patented feeding device, located at the top of the building above the kilns, the operation of which is at the command of the burner 200 feet or more away, and which records by means of red, yellow and green lights the exact status, as far as quantity is concerned, of the slurry feeding into the kiln.

The Kiln and Coolers

Next to interest attached to this plant because it is the first complete slurry system installed in North America where hard raw materials are used, comes that of the kilns, being the second installation of this type in the United States.

There are two kilns, each 170 feet long, manufactured by the Vulcan Iron Works, according F. L. Smidth design, the first 130 feet, measuring from the back, or feed end, forward, is 9 feet in diameter; the remaining 40 feet is 10 feet in diameter, the change is made on a taper. The entire kiln is lined with fire brick. The kilns are known as the enlarged clinker zone type.

The first 30 feet of the interior of the kiln is provided with a series of longitudinal lifters, the function of which is to increase the evaporating surface of the slurry, thus adding to the efficiency and economy of output. The slurry leaves the lifting zone with about 10 per cent water. One hundred feet further down follows a 10-foot section which is designated as the "combustion zone" where complete combustion of the fuel oil is intended to take place with a consequent expansion of gases and the maximum application of heat. By the time the mix has reached the combustion zone the carbonic acid gas is supposed to have been liberated and driven off with the stack gases and steam. Fusion takes place in the combustion zone and cement, or "clinker" is formed at approximately 2,500 regrees F. Each kiln is provided with its own stack, of reinforced concrete with fire brick lining, 8 feet diameter and 175 feet high. The stacks were built by the General Concrete Construction Company, Chicago.

The kilns are mounted with a per cent pitch on double rocker roller bearings, and are driven at the rate of 1 revolution in 80 seconds. Each kiln has its individual motor drive. The normal capacity of output for each kiln is 800 barrels per 24 hours, but are now making 900 barrels and may be crowded another hundred or two.

From the kilns the clinker passes directly by gravity into a Smidth cooler which is a revolving cylinder mounted immediately under and with its major axis paralleling that of the kiln from which it takes the clinker. The cooler is partially enclosed by an air jacket through which cool air is driven by a blower system, entering the cooler near the discharge end and travelling through the inside of the cooler its full length in an opposite direction to that of the clinker. Thus it will be seen that heat contained in the clinker and amounting to about 13 per cent of the total heat developed by the combustion of the oil is largely conserved by the air and is returned, under draft, to the combustion chamber of the kiln, where it becomes an efficient factor in burning the clinker.

Automatic Scale and Storage

The cooled clinker is forced forward through the coolers by a special internal arrangement and drops upon a Marcus shaking conveyor which discharges into a revolving, 4-section, weighing hopper connected with an automatic scale. Each section will contain clinker equivalent to $\frac{1}{2}$ barrel of finished cement and the moment this weight is reached the hopper dumps and the following section begins catching the clinker. By this means a close check is had at all times upon the output of the kilns.

The dumped clinker from the automatic scale is discharged from an elevator into a Link-Belt inclined bucket elevator manufactured by the Link Belt Co., Chicago and Philadelphia, which carries the clinker to the top of the clinker mill to be ground at once into cement, or by means of a portable belt conveyor may be delivered in the clinker storage building, having a capacity equivalent to 180,000 barrels of Portland cement. From the storage building the clinker is returnable to the clinker mill through an underground concrete tunnel over a belt conveyor and a bucket elevator to the same bins above the grinding mills into which it is discharged direct from the coolers.

The kiln building contains an Erie City Iron Works boiler installation which is used for heating the oil and operating the steam pumps. The oil is forced into the kilns under pressure of 100 pounds and is there met with an air spray at 15 pounds pressure, or at such pressure as may be necessary to give the flame the desired shape, the oil being regulated by a needle valve. The oil burners were made by Korting, of Germany.

Clinker Grinding and Cement

The charging floor of the clinker building is located well to the top and above it are the bins containing the raw clinker and the gypsum for correcting and regulating the setting properties of the finished product. On this floor is installed a scale for weighing in all charges, instructions for which are posted at the scale and checked off from a peg board. A steel car receives the raw clinker and a detachable box catches the gypsum after which the car is pushed off the scale to the steel bins, 500 barrels capacity each, immediately over No. 85 Smidth kominuters, and both clinker and gypsum dumped simultaneously.

Two kominuters do the preliminary grinding, reducing the clinker to 55 per cent through No. 100 sieve and 90 per cent through a No. 20.

From the kominuters the cement is drawn by a screw conveyor to the boot of a bucket elevator which delivers it to the steel bins, 500 barrels capacity each, above the tube mills.

Two long No. 18 tube mills, 20 feet in length by 6 feet in diameter, having a complete "silex," or natural stone, lining, complete the grinding of the cement and give a product which passes 87 per cent through No. 200 sieve and 98 per cent through No. 100. For grinding, the first 15 feet of the mills contain local beach pebbles and in the remaining 5 feet a steel product, known as "cylpebs," is used. The following tabulation gives the composition of the finished Portland cement:

Average Analysis of Cement

Components—	Per Cent.
Silica	22.16
Iron and alumina.....	9.86
Lime	63.84
Magnesia	1.26
Sulphur	1.54
Loss by ignition.....	0.84

This cement has been tested by the cities of Portland and Seattle. The results of the Seattle office show an average of 447 pounds for the 7-day, and 508 pounds for the 28-day tests. Portland reports 426 and 542 pounds respectively. The autoclave test reported by the company's chemist shows 670 pounds. The average setting times as reported by the city of Seattle are: Initial 3 hours; final 6 hours.

The tube mills discharge to a screw conveyor thence to an inclined belt conveyor which delivers it to a portable rubber belt conveyor on top of the silos where the cement is stored. There are 10 of these concrete silos, 27x65 feet, each of 10,000 barrels capacity.

The silos discharge into one of four portable screw conveyors thence to a central screw conveyor and by bucket elevator to the packing bins above the Bates machines, of which there are now two of 4-sack capacity each and space provided for a duplicate installation.

A special type of sack is used on these machines. It is previously tied by a wire and is filled from the bottom while attached to the machine upside down. The cement is sacked in canvas as needed only for shipment. One man attends a Bates machine and sacks about one barrel of cement per minute. When the sack is full the attendant pulls it from the filling spout and as he lets loose of it it falls upon a belt conveyor which delivers it to the truckers in the car. Each sack contains 95 pounds net and to check the Bates machine a low platform scale is used at certain intervals.

The Crew and Operating Force

The plant operates continuously and the 24-hour day is made up of two shifts, a day shift of 11 hours and a night shift of 13 hours. The night and day shifts are reversed every two weeks. The following tabulation shows the distribution of labor about the mill from the raw end to the packing house and the number on each shift:

Location—	Day Shift	Night Shift	Total
Stone and clay houses.....	3	..	3
Raw Mill—			
Crane and wash mill.....	1	..	1
Raw millers	1	1	2
Air lift and pump man.....	1	1	2
Kiln Building—			
Burners*	1	2	3
Oil pumps and boiler.....	1	1	2
Sweeper and helper.....	1	1	2
Clinker Mill—			
Millers	1	1	2
Scaler	1	1	2
Sweeper and helper.....	1	1	2
Gypsum and tunnel.....	1	1	2
Packing Dept.—			
Foremen	1	..	1
Packers	3	..	3
Truckers	5	..	5
Whole Plant—			
Oilers	2	2	4
Pumpman	1	..	1
Total			37

It will be noted that the yard and repair gangs are not included in this list. There are 7 men on the yard, 2 men on the repair gang, 3 men on the locomotive and switching, 3 electricians, 3 machinists and blacksmith.

The administration of the plant is immediately under a general superintendent who is resident at the plant. This is A. F. Krabbe, who assumed his duties

*The burners operate on eight-hour shifts, a head burner and two assistants.

October 1, 1913. His lieutenants are: V. K. Newcomer, assistant superintendent; Charles Shepard, general foreman, who has one assistant foreman on each shift; Stuart Smith, chief chemist, who has an assistant chemist, a night chemist, physical tester and two sample boys; P. Kaylor, chief electrician; John Gleave, chief clerk; F. Laville, repair foreman; C. Kingsbury, machine shop foreman. The following is a recapitulation of the operating force:

Location—	Total Employees
Quarry	25
Clay pit	3
Office, storeroom and laboratory....	13
Mill, yard and foremen.....	62
Grand total	103

Unique and Special Features

The slurry system has been described at some length because it is comparatively new to the American cement industry in its complete application to hard raw materials. Various modifications of the slurry system have been tried in the United States and some of these plants are not now in operation. Experiments with the wet-process in America date back 15 years or more.

The essential feature of the wet-process, using hard raw materials, is the wet grinding of the slurry, which eliminates the preliminary drying of the raw materials. It is claimed by its advocates that this makes possible the economical production of a very fine and uniformly mixed raw slurry; that, as a direct consequence, the clinker can be burned without the creation of dust and at a low temperature which results in a very small porous and easily ground clinker possessing the same uniformity as the raw slurry; that the economical burning is due to the fine grinding and the preheating of the air for combustion in the cooler to a temperature which is equal to or above the stack temperature, thus preventing any loss of heat in raising the temperature of the primary air.

An additional feature of this no-dust system is the complete covering, wherever practical, of all conveyors, elevators, grinding machinery, etc. Where dust might be created from the clinker after it leaves the kiln provision has been made for its collection into a sanitary system, which is peculiar to this mill and is the only one of the type in America.

The system consists of a Cyclone dust collector combined with magnetic shaking filter connected by ducts to dust casings on kominuters and tube mills, and to all conveyors, elevators and bins. By creating a vacuum inside all connections it relieves the mill of all floating dust.

Electrical Equipment

The electrical installation possesses a number of unique and interesting features, and its complete description is a long story by itself. Just a few of the high points will be here enumerated.

First, the high voltage operating under a potential of 2,200. All motors are of the latest design, indestructible, squirrel cage type with electrically welded end rings and cross bars. Those familiar with motor drives will appreciate what this high potential in motors means in overcoming the high starting torque peculiar to cement mills.

All motors above 50-h. p. use 2,200 volts, while those of 50-h. p. and less run on 220 volts.

The distributing system is wholly underground in lead covered, cambric insulated cables. The switching apparatus is carefully enclosed with grille work and under lock to which the electrician only has the key. It is all provided with disconnecting switches which permits of repairs without danger.

The Lenix belt drive is used on all the larger motors. It was developed by Smidth and is noteworthy for the remarkable short distance between the driving centers and the higher pulley ratios which it makes possible.

The electric current is received over the transmission lines of the Puget Sound Traction, Light & Power Company at 60,000 volts, A. C., 3-phase, 60-cycle, and stepped down to 2,200 volts. About 1250 kw. are consumed in the daily operations of the plant.

The entire installation comprises some 38 motors, including those at the quarry and clay pit, and are in units from 5 to 250 h. p.

Engineers and Contractors

F. L. Smidth Company, 50 Church street, New York city, are the designing and consulting engineers. The firm is of Danish origin and maintains its head office at Copenhagen. It claims to be the pioneer in the slurry or wet-process field and to have made important advances in its development. This firm has represented the owners of the plant, the Olympic Portland Cement Company, Ltd., London, England, from the beginning and are under contract to turn it over in satisfactory working condition.

In the erection of the plant the Smidth company turned over one of their erecting engineers, James C. Muir, who had complete charge of construction. But one outside contract was let and that for the machine shop, which went to the Butler Construction Company, Seattle.

With the physical erection complete, the consulting engineers have placed their chief chemist and operator, C. Pontoppidan, in charge to see that all machinery is properly adjusted and the plant in practical running order. Mr. Pontoppidan will soon discharge his responsibilities.

The design of the entire electrical system has been in the hands of Viggo Sahmel, consulting electrical engineer with the Smidth company. Mr. Sahmel has spent several months on the job.

Management and Sales

The directorate of the company resides, for the most part, in England and consists of Alex. B. Williamson, chairman, and Messrs. Geo. E. N. Booker, E. A. Davidson, R. B. Forman and William MacKenzie, Thomas Rose, secretary.

The agents and managers on the Pacific Coast are Balfour, Guthrie & Company, San Francisco, Portland, Seattle, Tacoma and Vancouver, B. C.

The sales management is largely confined to the Seattle office of the Pacific Coast agents as it is nearest the factory, the department being under the direction of W. P. Cameron.

C. M. Lewis.

HURST CONCRETE TANKS AND SILOS.

The Hurst Silo Co., 829 Exchange avenue, Chicago, Ill., have evolved a unique and practical system in the construction of their drinking tanks and silos. There have been innumerable demands for concrete drinking tanks; so we feel that a description of one for which great claims are made will not be amiss.

The patented concave recessed blocks used in the construction of the Hurst drinking tanks are 20 in. wide, 28 in. high (depth of tank) and 4 in. thick. They are made of Portland cement, sand, and gravel, and have four $\frac{3}{8}$ -in. steel rods running entirely through the block laterally. These rods are fitted with $\frac{3}{8}$ -in. steel links of the necessary length, whereby the blocks are locked together at the time of building the tank. The sections are set up in a circle, forming the walls of a tank of any desired diameter. The links are slipped over the rods as shown in Fig. 1 (B and D), and with a heavy hammer the points of the rods are bent back into the cavity as

shown at A and C. It follows that the more these points are bent back, the tighter the joint will be. The bottom of the Hurst tank is constructed exactly the same way as the bottom of a cistern, and is 4 in. thick, varying according to the diameter of the tank. It has a gentle slope up the side, to assist the steel rods in raising the ice in case of a solid freeze. No foundation is necessary under a Hurst Drinking Tank of 12 barrels capacity or less. Even on a larger tank the only foundation

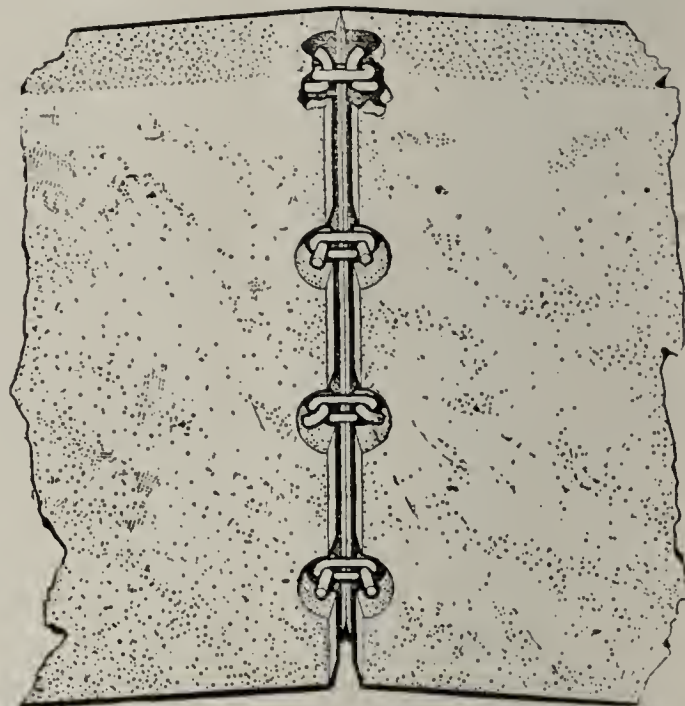


Fig. 1. Details of Joint in Hurst Silo or Tank.

needed is a circular wall of concrete 8 in. wide, extending to a depth of about 15 in. below the surface. The pipe connections for water supply are easily installed during construction, though this may readily be done at any time after the tank is completed.

The construction of the silo involves the same principles. The blocks used are about 2 ft. long, 1 ft. high and 4 in. thick, and are made of 1 part cement, 2 parts sand and 2 parts gravel or crushed stone. They are curved so that when laid up they form a perfect circle. The foundation of the silo consists of a circular wall of concrete, upon which the blocks rest. The wall is 12 in.



Hurst Concrete Silo Built For J. W. Sanborn, Spring Grove, Ill.

thick and extends far enough below the earth to insure its stability. In this silo the concrete bottom is about 4 in. thick and is troweled on top, making a waterproof surface. As the sections are laid in the walls, $\frac{3}{8}$ -in. steel links are fitted on the rods and bent back with a heavy hammer, as in the construction of the water tank. The cavity is then filled with cement. The interior of the Hurst silo is given a plaster coat of cement and sand 1:2, and finished with a brush coat of cement, making a smooth, hard surface, impervious to air and moisture. The door is very simple and convenient. It is put in place from the inside, and so arranged as to be watertight and weather-proof. The distance between the doors is left to the option of the man for whom the silo is constructed, but it varies as a rule from 2 to 5 feet. Two ladders, one up over the door and one leading to the dormer are used. These ladders are made of heavy soft steel rods $\frac{5}{8}$ in. thick, which are laid in the walls at the time of construction.

This will give the reader some idea of the methods followed by this progressive company in the manufacture of their water tanks and silos. Many claims can be made for such construction, inasmuch as the first cost is really the last cost, and they are so easily set up. The

WATERPROOFING CONCRETE

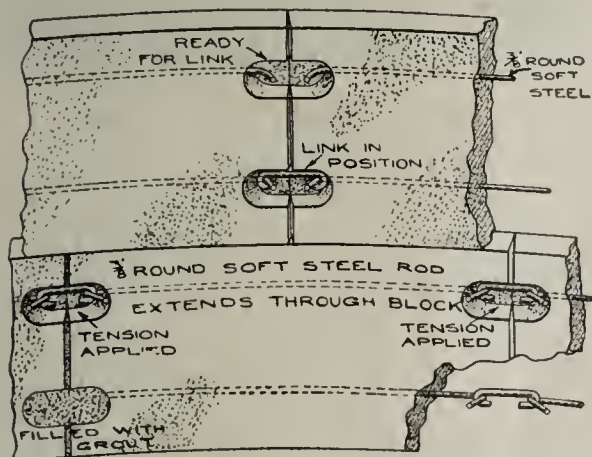
So many articles have been written by the manufacturers of different waterproof products and published, that it has been difficult even for the most expert to arrive at a conclusion, what is best suitable for his purpose. It is most certain and stated by the foremost architects and engineers that products composed of hydrate lime, calcium chloride and glucose in the form of liquids and paste, have little or no effect towards the waterproofing of concrete, but on the other hand, have a direct deteriorating action on the cement. Engineers and architects write in their specifications—"Clean water to be used for the mixing of concrete." Gauging water, highly charged with foreign chemicals, do not meet the specifications and when used, in a short time prove most disastrous and where cheap to start with, the manufacturer even in some cases producing bond, guaranteeing the results, are expensive in the long run, when the contractor is called upon to make good the faulty results of a poor waterproofing product, and then realizes he has no redress in the bond furnished, without lengthy and expensive litigation in court. Tar and felt and patented membrane systems have proven by test the life to be



The Hurst Concrete Drinking Tank.

Hurst Silo Company further claim that the cost of either the silos or the drinking tanks, when completed, is not more than wood or steel would be; and besides these advantages that being constructed on scientific principles, they will not rust, rot, crack, warp, twist or otherwise get out of shape. Exposure to the elements in no way affects them, as many years' experience has taught.

The Hurst Silo Co., 829 Exchange avenue, Chicago,



Detail of Construction (Patented)

Ill., are just issuing a new booklet which will prove interesting reading to our subscribers. Might we suggest that you get this booklet and read up on this style of silo and water tank construction?

but a few years, a fair demonstration being shown in the Washington street tunnel under the Chicago River, Chicago, Ill., the tar and felt system drying out and deteriorating as to be useless and other expensive methods were then resorted to. Surface applications of plaster to which certain quantities of waterproofing of metallic and bituminous substances are incorporated, are not practical. We all know well that a finished structure with the water pouring in, cannot be successfully plastered, even at a great expense. Should it be accomplished, it would be subjected to checks and cracks and falling off under the back water pressure, besides leaving the wall continuously wet when applied on the inside, which is not right in principle. This leaves the choosing of a successful waterproof product open only to the Integral method, with a powder product composed of compounds that have no direct action on the cement. Before we determine a satisfactory waterproofing, let us fully investigate the merits of the product and not be misled by attractive catalogued and misleading claims made by the manufacturer. A laboratory test does not cost the user much and his money is well invested. Competent waterproof materials are not cheap and results cannot be produced with incompetent and low price materials. A word to the wise. Fully investigate before you use a product, writes Hy. C. Morrison, General Sales Manager & Waterproof Engineer, Shamrock Waterproof Portland Cement Co., St. Louis, Mo.

The Lahontan Dam

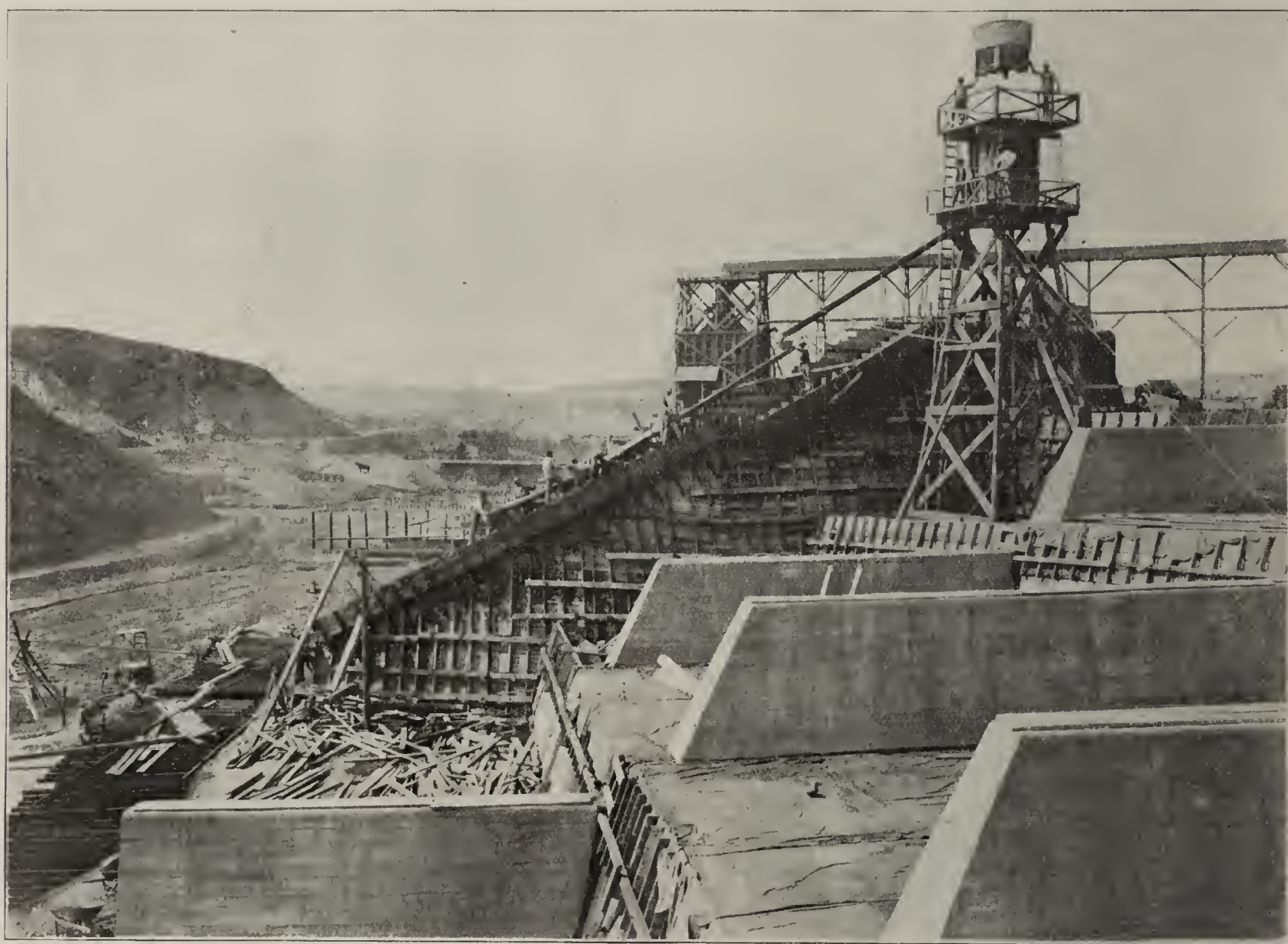
A. V. Leonard, U. S. Reclamation Service

The Lahontan dam is one of the most impressive engineering structures designed by the United States Reclamation Service and is being constructed in connection with the Truckee-Carson irrigation project in western Nevada. It is the larger of the two storage dams which have been contemplated by the Government to control water for the large areas of arid lands in this section. In order that the reader might better understand the purpose of this structure it is necessary at least to speak briefly of the irrigation plan of the project in which it is embraced.

The Truckee-Carson project provides for supplying water over several areas of land lying in the vicinity

posed to use the waters of the Carson River, collecting the flow of both streams in the Lahontan Reservoir to be formed by the Lahontan dam in the Carson below the outlet of the Truckee canal. From this reservoir the supply will be released into the Carson River and again picked up at a diversion dam lower downstream where the main distribution system commences. Both the Truckee and Carson diversion dams are finished and the Lahontan storage dam is rapidly nearing completion.

Actual work on the latter structure was commenced by Government force in January, 1911, and before the end of the same year the construction camp was com-



ONE OF THE IMMENSE SPILLWAYS UNDER CONSTRUCTION, LAHONTAN DAM.

of Fallon, Hazen and Fernley, Nevada. For this purpose it is proposed to use the waters of the Truckee and Carson rivers which have gone into natural depressions in the bed of the primeval Lake Lahontan and disappeared. The irrigating water comes mainly from snowfall on the mountains of eastern California, supplemented by the rains in the drainage basin of the Truckee and Carson rivers. The project is interstate in character as part of the water supply and much of the storage are within the State of California, while the irrigated lands are in Nevada.

The project involves the diversion of a part of the natural flow of the Truckee River through a canal into the Carson River, together with such stored water as may be conserved in Lake Tahoe in California. In addition to the flow from the Truckee River it is pro-

pleted and fully equipped for taking care of from 200 to 300 men. The dam is of the earth and gravel fill type, has a maximum height of 12 feet, a crest length of 1,600 feet, and a volume of 770,000 cubic yards. It will form a storage reservoir having an area of 11,000 acres and a capacity of 290,000 acre-feet. The embankment is to be 20 feet wide on top, with an upstream slope of 3 to 1, protected by 2 feet of riprap, and a downstream slope of 2 to 1, protected by 12 inches of riprap. Near the upstream toe of the dam there is a cut-off trench 15 feet in depth, having a concrete wall 2 to 4 feet in thickness extending to an additional depth of 30 feet.

Two enormous concrete spillways have been constructed in the embankment near the ends, one on each side of the river, having the crest 12 feet below

the top of the dam. The length of each spillway is 250 feet and the water flows down over concrete steps, winding through about 90° to the opposite sides of a central circular pool in the river bed near the toe of the dam. This pool will have a diameter of 220 feet and a depth of 30 feet, and will serve to retard the velocity of the water sufficiently to allow its discharge into the old river bed without danger of eroding the soil. The outlet works consists of twin concrete conduits of horseshoe shape, approximately 9 feet in diameter. The gates are to be operated from a gate tower at the upper end of the conduit.

The principal feature of the installation work has been in the construction of a hydro-electric plant of 1,000 kilowatts capacity in duplicate 500-kilowatts units, designed to furnish power for operating the

THE TESTING OF SAND FOR CONCRETE

There appears to be an increasing amount of attention paid to the inspection and testing of materials for concrete. Repeated study of the subject by many investigators seems to show the necessity for gathering more minute data of such materials than was recognized in engineering practice a few years ago. The mere testing of briquettes of cement, or of cement and sand mixed in desirable proportions, in order to determine the strength of the cement after allowing it to set for a certain period is now considered to fall short of such investigations as can give other information that ought to be had regarding the properties of the materials which go into the concrete.

The importance of looking to the quality of the



LAHONTAN DAM IN PROCESS OF CONSTRUCTION.

construction plant. This was completed in December, 1911, and has since been in continuous operation for power and lights on the work and in the camp. When the dam is completed it is expected that use will be found on the project for the entire 1,000-kilowatt capacity of the power plant. A mill was also constructed for regrinding Portland cement with a fine sand found at the site of the dam which produced a so-called "sand cement" and the use of this material by the Government has effected a considerable economy in the cost of concrete work.

In view of the fact that the great Lahontan dam is one of the agencies by which thousands of acres of public land in this territory are to be reclaimed, its rapid completion is awaited with widespread interest. Government officials assert that the work will unquestionably be finished this year.

sand has always been recognized, but the specifications have usually been brief and readily applied. In very general practice the only requirements as to the sand have been that it should be sharp and clean; that is, free from loam or clay. In a paper read before the American Society for Testing Materials, at the recent annual meeting, Mr. W. B. Reinke presented some thoughts on the testing of sand which apparently express the results of studious observations on tests of this kind, in which it would appear that the usual tests or inspection requirements of this material are all too meager. In fact, that gentleman insists that the inspection of sand entering into any concrete construction is just as important as the inspection of the cement, and may require quite as much attention as, if not more than, is given to the cement. His explanation points out that this material, as found in its

natural state, may vary widely in quality, and, when it is considered that it forms two to four times as much bulk in the composition of the concrete as does the cement, its effect on the ultimate strength of the concrete cannot be ignored.

After a good deal of experience in sand testing he concludes that sand may even be too clean for best results, and that it need not necessarily be sharp. He has found other conditions which are quite as essential to the desired quality of the material, but which are not usually taken into account. Among these the granulometric state of the material, or the proportion of fine grains to the coarse ones, is very important, as upon it depends the relative quantity of water required to produce a mortar of given consistency. Another condition which may affect the strength of the concrete is the amount of mineral matter, such for instance, as soluble alkalies, contained in the sand that may have a harmful effect on the concrete.

So far as we are aware, no previous writer has quite so clearly brought out the influence of the quality of the sand on the amount of water required, to bring a sample of such material to a working consistency; and this amount of water he claims is one of the best means of determining the quality of the sand. This quality is predicated on the reduction of strength which results from adding enough water to bring the mortar to what he calls "work consistency," this usually requiring about one and a half times as much water as is required to mix the mortar to normal consistency.

The influence of the quality of the sand on the mortar by the use of this additional water is so great that in some mortars of normal consistency, where the sample of sand used may produce a mortar of strength that is greater than can be obtained with the same cement in equal proportion, when using standard Ottawa sand, may lose as much as 70 or 80 per cent of strength developed, as compared with a loss of 25 to 35 per cent for mortar made from Ottawa sand, up to the 28-day period. Other things being equal, the sand having the larger amount of fine material will have the larger amount of surface to be covered, and will require more water when mixed with a given amount of cement. For this reason it does not necessarily follow, in making comparative tests of sands, that the same amount of water should be used with the different samples, but the criterion should be to use enough water to bring the different mortars to the same consistency, and then note the relative strength developed. As a result of these studies he concludes:

"1. That the less water required to produce a mortar of a given consistency, the higher will be the strength developed by the sand.

"2. That the coarser the sand, other things being equal, the greater will be the strength developed.

"3. That the higher the silica content, other things being equal, the greater will be the strength developed.

"4. That where it is necessary to use sands of poor quality, loss in strength at early periods can be largely overcome by using a dry concrete.

"5. That the loss of strength is confined chiefly to short periods, being practically overcome with time."

This writer remarks that, while the testing of sand for concrete is becoming more general, the method of laboratory tests differ widely, as well as do the specifications that are written from knowledge derived from these tests. He finds that the following are usually

tests to which samples of sand are submitted, in different laboratories, but rarely are all of these employed in any one laboratory.

1. Determination of the percentage of moisture;
2. Determination of the percentage of voids;
3. Granulometric analysis;
4. Determination of the percentage of silt;
5. Chemical analysis to determine silica and content of clay matter;
6. Loss on ignition;
7. Volume of mortar from a given amount of sand and cement;
8. Comparative tension tests of mortars made from work sand and standard Ottawa sand, using identical cement and only sufficient water to produce normal consistency.

He urges that all comparative sand tests should be made on cubes or cylinders subjected to compression, which is the standard practice in Germany, and that to the tests above mentioned should be added the following ones, which are not usually found in practice:

1. Microscopic examinations, which need not necessarily be exhaustive;
2. The effect on strength developed by the use of different cements;
3. Permeability of resulting mortars;
4. Weight per cubic foot as received and dried;
5. Determination of the amount of organic matter contained;
6. Tension, or, preferably, compression, tests on wet mortars having the same consistency as is used on the work.

The tests on wet mortars he believes to be the most important ones for determining the quality of sand. The method of procedure in tests carried out in his laboratory practice is described as follows:

"The sand to be tested and Ottawa sand are first made into mortars of normal consistency, using preferably cement from the work. These mortars are then made into briquettes, the whole operation being in accordance with the prescribed methods of this society for the making of sand briquettes when testing cement. The amount of water necessary to make a mortar of normal consistency having been found, a new batch of sand and cement in the desired proportions is thoroughly mixed dry and placed in a cylinder that can be revolved, together with a number of flint pebbles, so that the proportion of the cement, sand and stone will approximate that desired in the actual work. To this mix is added enough water (generally about 50 per cent more than needed for normal consistency) to make a mortar having work consistency. The cylinder is then closed and revolved for five minutes. The flint pebbles are picked out by hand and the mortar is made into briquettes. This test more closely approximates the conditions found in actual work, and the strengths obtained from briquettes made from such a mortar, though, as a rule, far below those obtained from a mortar of normal consistency, correspond to those that may be reasonably expected from the mortar if the sand and same cement are used in construction.

In former years there was much investigation of the relative merits of wet and dry mixtures, and each side had its advocates. It may well be, therefore, that in many instances seemingly conflicting claims were both right, in that the results pointed out pertained to sands of different qualities, some naturally requiring more water per unit volume than others.

Reinforced Concrete Factory Buildings

By Harry C. Spillman

The great changes which have occurred in manufacturing during the last decade have brought about a new epoch for industrial buildings. Improvements in modern machinery, methods of operation, Scientific Management, high-speed steel and short cuts in production have demanded buildings suitable for the line of manufacturing they are intended to house. The highest efficiency can only be obtained by having buildings planned to secure these ends. The small factories of a few years ago are mammoth institutions today. The owners of these plants have discovered that their plants have become many times larger than their fondest hopes in the early days of their organization, and many of these owners of manufacturing plants are face to face with the vexing problem of more room.

If these owners will study their present conditions

into or crowding out another department. All factories demanding larger quarters are growing concerns and their new plant should be capable of taking care of all future requirements. If this point is lost sight of the owner will find within a few years that he will have to rebuild again. These are the main features of making preliminary plans for factory buildings, and it is always best to lay out the factory and purchase the property to take care of the lay-out instead of trying to make the building fit the property. If this is not done the buildings will have to be altered and rearranged, and the plants will not be entirely satisfactory when completed. It took years for the idea to be fully realized, that intelligent planning means economy. An expert engineer can save many times his salary during the construction of the building, and his fee will pay big dividends in after years.

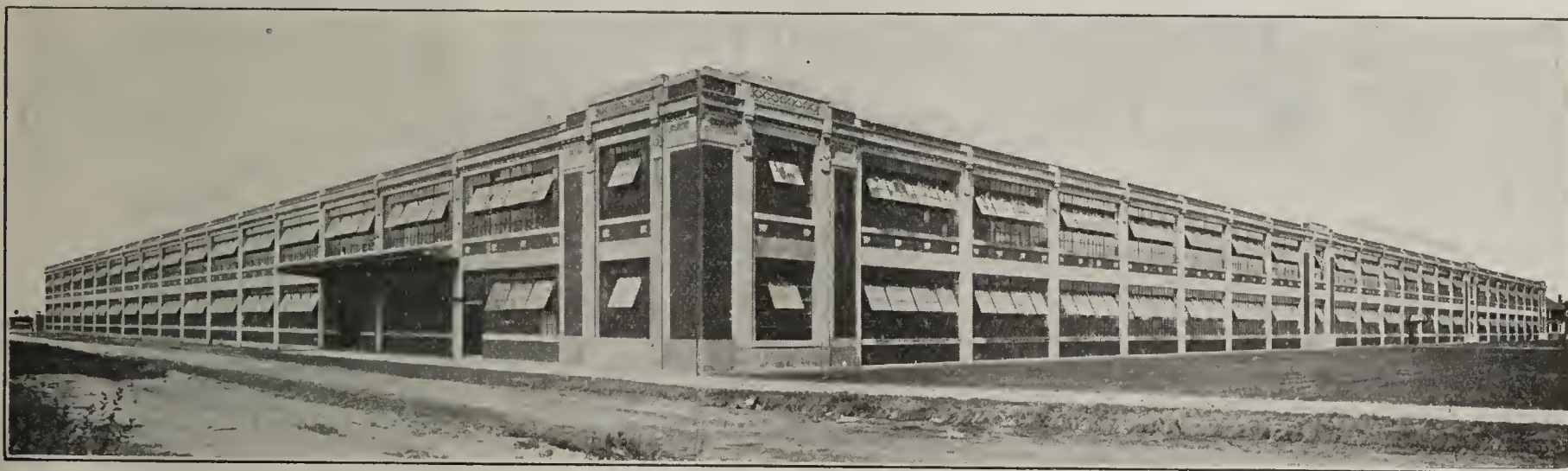


Fig. 1. A Reinforced Concrete Factory, Showing the Architectural Beauty Worked Out With Ordinary Concrete and Pressed Brick.

they will find their plants, from the manufacturing standpoint, in a more or less chaotic condition and their manufacturing costs climbing up. Increased room demanded in one department has blocked the expansion of another; machines have been crowded into small spaces without sufficient room for the operators and material; the trucking aisles are too narrow and the material, instead of having a continuous routing from the rough stock room through the manufacturing and assembly departments, takes a zig-zag course, retracing its steps and meeting itself going and coming in all parts of the factory. This requires a small army of truckers, inspectors, and stock chasers to keep this material in process of manufacture, and the department heads are becoming worried over delays and cancelled orders.

The only solution to this problem is a factory built especially for the work intended. This has created a new engineering field, as it calls for an engineer who can plan buildings suitable to meet the exact conditions and the routing of material without retracing its steps, so that it travels in straight lines. This labor-saving, in cutting down to a minimum the trucking of material, will often save the manufacturer a sufficient amount in his manufacturing costs to warrant the expenditure for a new plant. The engineer must plan for future expansion, so that each department can grow almost indefinitely without running

In choosing a site, properties located away from the heart of the city near the suburbs, but having good street-car connections and shipping facilities, make the best locations. Property in such a locality is cheaper, and there is sufficient room for future expansion; moreover, living conditions for the men are far better. It attracts the best class of workmen and the men are more contented than in the crowded shops in the city.

After the preceding requirements are carefully considered, real designing of the factory commences, and the type of building is one of the first problems. Reinforced-concrete buildings are popular, and certain facts concerning this type will be of interest. They are lower in ultimate cost than other kinds of buildings; in fact, their first cost comes very close to that of slow-burning mill construction and is lower than that of fireproof steel construction. Concrete has a low depreciation charge. In reality, as concrete becomes harder with age, a reinforced-concrete building originally designed for four stories will allow a fifth floor to be added after the building is three or four years old. Authorities on depreciation give a maximum depreciation of 1.5 per cent per year and some as low as 0.75 per cent.

A reinforced-concrete building is fireproof. This is of high value to a manufacturer in reducing his insurance and preventing a bad fire in his factory, which

generally gives a manufacturer two or three years' setback, and often proves disastrous to his business career. Fires of intense heat penetrate concrete less than an inch, which does not allow the reinforcing steel to become exposed. Replastering the thin layer of concrete which the heat has disintegrated, the replacement of the broken glass, and a new coat of paint will make the building as good as ever.

Reinforced-concrete buildings are built of the skeleton type, which allows a maximum of glass area; generally, 75 per cent of the wall area is glass. The flood of daylight throughout the plant increases the workmen's efficiency, and also cuts down the lighting bills. The large window area allows more ventilation and enables the owner to increase the width of the buildings and still have sufficient light at the center.



Fig. 2. A Flat Slab Ceiling Made Entirely of Reinforced Concrete.

The sanitary qualities of reinforced concrete buildings bring forth another advantage, as a building of this construction is free from dry rot and dampness and it can be thoroughly washed out with a hose without damaging the building. Sanitation makes healthful working conditions which have a direct bearing upon the efficiency of the workmen.

A characteristic which makes reinforced-concrete buildings stand out from all other classes of buildings is the load-carrying capacity and the ability to absorb vibrations. A floor designed for 150 pounds live load per square foot will generally carry a load

But little difficulty is experienced in installing machinery in concrete buildings. Embedding small strips of wood in the concrete and nailing to these strips a sub-floor of $1\frac{1}{8}$ -inch pine and over this a maple floor about $1\frac{1}{8}$ -inch thick, makes an excellent floor for manufacturing purposes. It gives $2\frac{1}{4}$ -inch thickness of wood, so that the machinery can be easily fastened by means of lag screws. This floor is easy on the men's feet and shows excellent wearing qualities. By means of embedding in the concrete ceilings cast-iron spools threaded for a $\frac{3}{4}$ -inch bolt, or placing long metal inserts in the concrete ceiling, shafting, piping



Fig. 3. A Flat Slab Ceiling Made of Tile and Plastered Underneath.

of two or three times this amount without showing any deflection, and in case a heavy load is concentrated on a small area, it will distribute this load over a large floor area.

and electrical conduits can be easily suspended. For attractive appearance reinforced-concrete buildings can compare favorably with other types of constructions. By the clever use of ordinary pressed brick,

and cement plaster a well-designed reinforced-concrete building will equal in beauty the most expensive buildings made up of brick and cut stone. Beauty in manufacturing plants is of recent origin. Its value has many factors which make it impossible to measure. Workmen take pride in the place in which they work. The advertising value is of importance, and neatness and beauty raise the property value. Such a building is a source of pride to its owners and expresses the ideals of the company to the public.

The remarkable development of reinforced concrete has brought upon the market many different designs which have certain advantages for the work intended. The girder type works out very successfully for long spaces, if it is desired to have the building entirely free from interior columns, with large, unbroken floor spaces. The outside building columns are placed on about eight-foot centers and a heavy concrete beam is poured from column to column across the building. The floor above is usually a concrete slab (about 6 inches deep) resting directly upon these girders. The only objection to this type of construction is the great depth of the concrete girders, which sometimes is as much as five feet.

If the building has interior columns the builder has the choice of a floor supported on beams, girders and beams, or a plain flat slab. Using the former method, there is some difficulty in running pipes and electrical conduits, as the beams offer an obstruction.

The flat slab has one advantage in that the ceiling is entirely clear of obstructions, and shafting, piping and electric wiring can be easily installed. There are several methods of flat-slab construction. The best for manufacturing plants is a solid concrete slab of 8 or 10 inches thickness. This adds additional weight, which has to be taken care of in designing the building, but this extra weight absorbs all vibrations from moving machinery which can be placed on any floor. Another flat-slab scheme is to use hollow tile and insert a narrow concrete beam between the various rows. This method calls for the tile to be plastered underneath in order to obtain a finished job and gives a lighter slab. It makes an excellent floor for offices and stock rooms, but lacks the necessary weight to absorb machinery vibration. It is customary to design reinforced-concrete buildings with the interior columns spaced between sixteen to twenty-five feet, according to the use of the building.

The reinforced-concrete building successfully answers all problems in building construction for manufacturing purposes; when completed it will be as substantial as though cut out of solid rock, and will possess the combined qualities of granite-like concrete mixed with steel.

CEMENT DRAIN TILE

I note with interest what William Passage, of Bailey, Mich., says on page 3 of your January issue, regarding his experience in making cement drain tile. Letters of this kind are just what the clay products paper are looking for, and the chances are this letter of yours will be copied in every one of these papers next month. To an experienced tile manufacturer your letter explains all of your trouble. If you have good clean, sharp sand, which I suppose you have, there are three reasons why your tile are not good, and anyone of these would make your tile absolutely useless; writes W. J. McCracken, Sioux City, Iowa, a former cement tile manufacturer and now president of the McCracken Concrete Tile Machine Company.

In the first place you are using a mixture of five to one, and this mixture will not make a good tile even if you had a tile machine that would pack them as hard as it is possible to pack a tile. In the next place you

are using a machine that will not even pack the tile hard enough so that they will stand after the jacket is removed without having to keep them in a casing until they have set sufficiently to stand alone. Now if you were using a mixture of two to one or we will say as rich a mixture as you want to make, you could not possibly make a good tile unless you packed it. So no matter how rich a mixture you use, if you do not pack the tile so that they are very dense, your tile will not be strong and they will not last. You also say that you sprinkled the tile three times a day. Now, if these tile were made in hot weather, the chances are that you did not keep them thoroughly soaked, and that they had time to turn grey or light colored before they were sprinkled again, and of course after a tile has a chance to dry out enough to be light in color, you had just as well save the water, as it is too late to do it any more good with sprinkling.

The only way to make good cement tile is to have machinery that will turn you out tile that are perfectly true in shape and packed very dense and hard. Then it is up to you to use a mixture of not less than $3\frac{1}{2}$ to 1, and I find that most of the experienced tile men who have been in the business for the past seven or eight years are using a mixture of 3 to 1, which is really the proper mixture to make first-class tile. This mixture with a good practical tile machine, and a good mixer will turn you out tile that will be superior to any clay tile, and of course it is necessary to see that every tile is properly cured, or even with good material and good machinery, your tile would be absolutely worthless. I would judge from your letter that you are not properly lined up in any department to make good first-class tile and make them at a profit. In the first place the mixture you are using would not make good tile under any conditions, and if it would you cannot possibly make good hard packed tile and make them at a profit with a little cheap toy machine that probably cost less than \$25.00 as the operation of your machine is so slow that even if you were making good first class tile, they are costing you more than it would cost you to buy tile from your local dealer.

These cheap toy tile machines are not only losing money for hundreds of owners, but are furnishing arguments for the clay people to use against the cement tile manufacturers who are really making good first-class tile. There are more cement tile factories in Iowa than in any other two states, and the cement tile have been winning out over the clay for the past few years, and nearly all of the state and county contracts are going to the cement tile people. This is simply due to the fact that all of these plants are equipped to make first-class tile and make them fast enough to make the business profitable. To give you some idea of what a real cement tile plant is, the Cement Products Company of Spencer, Iowa, uses 400 bags of cement every day, and they make nothing but cement tile.

The thing for you to do is to either get right, or get out of the business. You are not properly equipped to make a success of the business, and the more business you do, the worse you are off, as you simply cannot make good tile at a profit with the system you have. We are not writing you this letter to induce you to buy a McCracken Tile Machine, but if you stay in the business and want to make tile that will give satisfaction, you should install some good tile machine that will really make you good hard packed tile, and then it will be up to you to use a good mixture, and cure the tile properly. There are a number of good tile machines on the market and there are a few more machines that are in the class with the one you have.

How to Produce Realistic Stone Facings

There is no feature of the concrete industry that presents so many attractive possibilities and so much profit, as the production of strictly high class concrete stone of artistic finish—a stone that equals or excels natural stone in beauty as well as quality.

No one qualified to judge disputes that concrete, rightly made, is superior to stone for building purposes and it is a simple thing to emulate the aesthetic feature of Nature's best offerings if we go back to first principles and start right.

It is to be deplored that cement was not better understood or that it did not fall into better hands at the beginning, for there is no question that it is the inherent ugliness of the concrete block, as commonly made, that bars it from the best structures and it is for the progressive block men to remove this fault if we are to elevate the industry to the plane where it

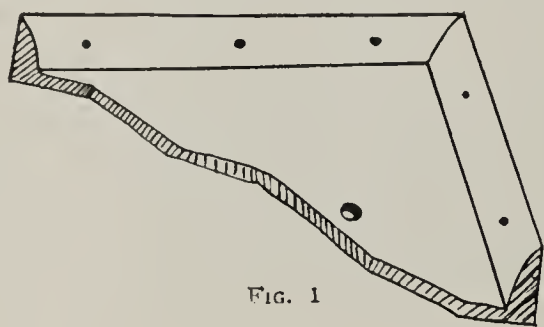


FIG. 1

belongs. The task is an easy one, and pleasant, if we but give heed to Nature and follow her teachings. She was the first stone maker and is worthy of praise. If we surpass her it is because we can gather her scattered forces and unite them to suit our individual tastes.

The people of the present generation, while they are not looking for rat-holes to chuck their money into, are more willing to pay the price for what appeals to their aesthetic tastes than any that have preceded them, and this sentiment is growing rapidly. They recognize the many desirable qualities of concrete as a material for home building but frequently turn it down for its lack of beauty, and the block-maker foolishly tries to reduce the cost to make competitive price the issue in marketing his wares,—a great mistake! It is safe to say that if one half the energy expended in reducing the cost of concrete (and incidentally its quality) had been intelligently brought to bear on the production of a better concrete of artistic finish, concrete would today reign supreme, to the exclusion of stone. What popularity concrete products enjoy today is due solely to their inherent merit and in spite of much of man's foolishness. Why not stand on our dignity? Lowering the price belittles the standing of the product. Concrete is better than stone! Let us make it more beautiful also and the price will take care of itself. Every cent added in this direction will bring three or more in return.

There has been a decided tendency in this direction in the last two years, chiefly through the advent of white cement, which is a good starter but does not go far enough. The fault does not lie with the cement alone—we must look to the aggregates for relief and eliminate as far as possible all traces of cement. Here Nature has come to our aid by supplying us with everything necessary to reproduce her handiwork. We have at our command such aggregates as red, white and gray granite, various colored marbles, limestone, trap rock and silica sand in white, cream, yellow, orange, red, brown, and purple, all in natural colors that never

fade. By judicious use of these, separately and combined, an endless variety of color effects can be produced in realistic stone facings.

It may be well to avoid misunderstandings by stating that while all sand contains more or less silica, that termed silica sand, or simply silica, is nearly pure silica and is much harder than bank, lake, or river sand which contains more or less granite, trap rock, limestone, etc., and it also has more life and sparkle as each grain is a crystal. The granite, trap rock, etc., have little color influence over the concrete until the surface has been treated with acid. On the other hand the colored silicas (excepting the white and cream), especially the red, brown and purple, have great coloring properties, so much so that even when used with twice their volume of other aggregates they dominate the color, but they should be used alone as an aggregate when a deep color is wanted.

It should be borne in mind that while the surface cement—that which coats the exposed surface of each grain of the aggregate used in the facing—is removed by the treatment given below, the cement that binds the mass of aggregates together is sure to show more or less in the interstices, and will influence the color scheme of the finished stone in proportion to the size and number of these cement-filled spaces.

It is obvious, therefore, that while coarse aggregates are essential for the body of the stone on economical principles, it is equally essential to use fine, but well-graded aggregates for the facing, that the cement-filled spaces may be as small as possible. Accuracy in reproduction also demands this, as natural stone is fine-grained unless it is a conglomerate. Furthermore the aggregates and cement must be thoroughly incorporated so that the facing will not be like Pat's pig, "a strake of lean and a strake of fat" or have "hunks" of neat cement to mar the finished job. It is likewise apparent that judgment should be exercised in choosing a proper cement for each aggregate. Where the color of the aggregate is not pronounced, as in granite and most stone and in the white, cream and yellow silica, white cement should be used, or it may be advisable to use white and gray mixed in various proportions. Gray cement may be used with orange, red and purple, but white cement gives clearer and more cheerful tones. With brown silica the gray cement has an undisputed field. If it proves too dark, a portion of fine bank sand may be used to cut down the color and cost, writes Charles Doubler, in *Concrete-Cement Age*.

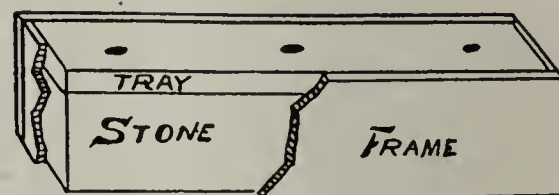


FIG. 2

Concrete is in reality nothing less than stone as all its components are found in natural stone, but it is made according to scientific principles which give it the properties to defy fire and frost and to improve with age, qualities few stones possess. It can be substituted advantageously for all kinds of ordinary stone work and in the same style. We should not, however, abuse this privilege by miserable imitations, as has been the custom. Take for example the so-called "rock-faced" block, made to imitate pitched stone.

While pitched stone is the cheapest product of the stone cutter's art it is also one of the most effective and popular for general use. A wall built of it owes its catchy, picturesque beauty to the diversity of "faces" wherein monotony cannot exist (for no two stones are alike) and to the clean fracture and sharp edges. To imitate such a wall with mud-colored block all of one size and all made from one mussy, round-edged, cast-iron face plate is not only a travesty but a crime against nature and art that cannot be too severely censured by those who have the future welfare of the business at heart. We may reproduce (exceptions are taken to the term imitation being applied to this class of work) this wall, however, and even improve on the color scheme, all within our rights and in good taste. To do this we have but to make composition face plates in good variety, both in sizes and designs, that we may follow nature and rid our work of that stereotyped effect caused by repetition. Composition plates should be the only kind used for "rock-faced" bush hammered, tooled blocks, etc., if you wish to secure the aesthetic trade. Metal will do for plain, smooth surfaces only.

Have a stonecutter cut as many patterns as you want. They must be the exact size of your mold box. Have as many lengths as your machines will make and some fractionals. The "pitched stone" should have plenty

so that the top edge will be flush with the inverted bottom of the iron tray when it rests in position over the stone pattern. (See Fig. 2.) Oil the stone and place face up in this frame and mix enough Artura composition to a fairly thin batter entirely to cover the face of the stone, and pour at one place in a small stream, allowing it to spread over the stone by gently shaking. This will prevent "air bells" forming on the surface and insures a perfect impression. Back this up with the same composition mixed considerably thicker and fill the frame nearly full. Then invert the tray over this mass and force down into position on the stone by pressure. The excess composition will be forced up through the holes and can be used in the next mold. Allow the mold to remain on the stone for 48 hours in a warm place, when it may be removed. The mold or face plate should be allowed to cure for 6 or 7 days in a warm room, without water, and then thoroughly shellaced and, when dry, oiled. If it is necessary to have the plate in use on short notice much time may be gained by using heat to cure the plate. In this event, raise the temperature to 125° to 150° F. after it has stood 2 or 3 hours and keep it at that temperature for 4 or 5 hours, when it will be quite hard and may be removed from the stone, and a further curing at same temperature for 5 or 6 hours will suffice to render it fit for use as soon as it has



of draft so the impression will pull away from the stone freely, and they should be in good variety—some bold, others less so, and others quite flat but well marked by the cleavages. Select stone for these patterns that break with a sharp, well defined fracture and good grain, as you are going to reproduce it exactly. Be very particular in this, for only good, well defined demarcations and sharp edges can give character to your work.

Have patterns made—one for each size—for cast iron trays, or frames to hold and support the composition. These patterns must be the right size, allowing for shrinkage, so that the casting will exactly fit your machine, or better still, have them a trifle large and machine them to size—then they will be exact.

Fig 1 is a sectional view of an inside corner of a finished tray. The dots on the sides are countersunk holes $\frac{1}{8}$ " deep to give a good "key" for the composition, and the one in the bottom is a $\frac{1}{2}$ -in. hole to allow the air and excess composition to escape when under pressure. There should be three of these as shown in Fig. 2. The sides should be from 1" to 1 $\frac{1}{2}$ " high inside, $\frac{3}{8}$ " thick at bottom and rounding up to an edge at the top as shown in cut. The bottom should be $\frac{3}{16}$ " thick.

Make frames exactly fitting around these trays and the stone patterns out of 1" lumber and wide enough

been treated with shellac. If properly made it will be a perfect negative of the cut stone. It will last a long, long time under ordinary usage, as it is hard and tough and will withstand tamping by hand or machine, but should not be hit with the tamper unless covered with concrete. Keep the patterns and you can reproduce the plate at any time. For the facings use 1 part cement to 2 parts aggregate; if a little extra sparkle and life are wanted add a little finely ground mica. Mix thoroughly while dry and temper with clean water to a point where a ball of it, when squeezed together in the hand, will not crumble when the hand is opened. Cover the face plate at least $\frac{1}{2}$ " thick with this facing and before tamping cover it with several inches of the common concrete. If a coarse concrete is used for the backing it is best to screen out the coarsest pieces for the first layer of 1" that goes on to the facing for fear of tamping these through the facing. Use as wet concrete for the body as your machine is capable of handling.

There are two treatments for removing the surface cement, i. e.—spraying and the acid wash. The former is cheaper and more quickly done, but the latter is more effective, while the two combined are ideal. The expense in any case is too trifling to be considered if good results are desired. Fit a fine spray to a hose which also has a stop-cock so the water can be cut off

instantly. Direct this spray without too much force against the face of the block when it comes from the machine, but no faster than the block absorbs it, and stop before it begins to run or it will "muss" your facing. The water washes the surface cement back into the block, to the advantage of the appearance and quality of the block. The acid should not be applied until the block is sufficiently cured to be safely handled. Have a wooden tub, and place in it 4 or 5 parts clean water (soft preferred) and 1 part of the cheap, commercial grade of muriatic acid. Place the block face up on the edge of the tub and at an angle, so that the surplus acid solution will drain back into the tub, and wash the surface with a jute brush dipped into the acid solution. Brush gently but do not scrub or you may flatten and round the sharp points. The acid will attack the cement and foam vigorously. When it ceases to foam, the surface cement has been transformed into chloride of lime and this should then be thoroughly washed off under a tap or hose, the whole operation requiring but a moment. The aggregates being relieved of this cement coating will now shine and sparkle in their original beauty and your work will be a credit to you and your business.

If the work is done with skill the result will be such that when seen in the wall no one will know, or care, whether it is natural or artificial stone, in fact, expert stone cutters have remarked that the reproduction was so perfect, the appearance of a fracture so exact and natural, that no one would suspect it to be other than real stone. Architects have declared themselves as preferring it to stone, as it can be modified to carry out any color scheme.

If an impervious facing is desired, apply a colorless, transparent waterproofing. This not only fills any voids and excludes water, but brightens up the color as well, and the block will be about the same shade in wet or dry weather. Remember that either stone or concrete is much darker wet than dry, so never judge the color until dry.

Block made as described are not to be classed with the ordinary concrete block, nor do they have to compete with them in price. Stone is their only competitor.

Besides the satisfaction of producing an article that will advertise your business, there is twice the profit in it for less work, all to the betterment of the concrete industry.

CONCRETE PIPE

As a result of an investigation which has just been made by Water Engineer Whitman it is possible that concrete pipes may be used in the construction of the big water main that is to be laid between the filtration plant and the Clifton Park reservoir, says the Baltimore Sun.

Mr. Whitman went to Ampere, N. J., to witness a pressure test of concrete water pipes of varying sizes and came back greatly impressed.

"I saw," said Mr. Whitman, "four lengths of seven-foot water pipe that had been under a 50-pound pressure test for 48 hours, but which showed only a little sweat and no leakage whatever.

"After my investigation I believe that it will be possible so to draw our own specifications for piping as to bring concrete into competition with steel piping. It offers decided advantages in the way of more permanent construction, and I believe the first cost would be cheaper."

CEMENT DRAIN TILE

Referring to article published in your January issue on page 3, by William Passage concerning his sad experience in making cement tile, will say that the information given shows that the tile that disintegrated was made of a 5 to 1 mixture,—a mixture so lean in cement that it is probable that but half the voids in the sand were filled with cement. What can anyone expect in the way of strength from such a mixture in the thin wall of a drain tile? Evidently the manufacturer thought such a proportion good enough, however, for he states that he knows that one three inch cement tile will drain more ground than two six inch clay tile! Analyzing his thought, he means to say that his cement tile were made so porous that water would percolate through his cement tile and thereby take water from the ground quicker than the two clay tile of twice the diameter combined. Again, we see evidence that the cement tile which he made was very porous and that the manufacturer was glad they were so. The fact is that the theory of a porous wall tile being better than a dense wall tile gained credence in late years largely through the advertising handed out to the public by cement tile machinery manufacturers who desired to sell machines and in order to show large, attractive profits represented that lean mixtures were good enough for durability and an advantage in drainage qualities due to the porosity obtained with such mixtures. As a matter of fact if advocates of porous wall tile would stop to consider that a line of tile will take in all the water it can carry at the joints, and will stop to think that the amount of water that could soak through the wall could not be any large amount comparatively, and further, will consider how difficult it would be to lay a line of tile so tight that water could not enter at the joints I think they will see that the practical utility of cement tile simply because they were porous is of too little value to be seriously considered. The manufacturer who has endeavored to produce tile of such a nature has either taken a back seat already or must very soon change his ideas.

A porous tile is necessarily a weak tile. It cannot be otherwise in comparison to a dense one. A porous tile must be made of damp concrete rather than wet concrete, hence there is a tendency for insufficient moisture to properly set the cement. A porous concrete dries out rapidly, hence, sprinkling may not be attended to quick enough and in sufficient quantities, and, if the water in the mixture is allowed to evaporate no amount of subsequent sprinkling will offset the damage done. A porous tile is one which offers little resistance comparatively to the acids of the alkalies and acids frequently found in the soils of Michigan and the arid West. A porous tile is usually the product of an inferior machine, for, with a good machine and a good concrete the tile produced should be so dense as to absorb not over 6 to 8 per cent water when immersed in water for 24 hours. It takes good concrete and a machine that will apply a good deal of pressure, a very great deal, within forms of considerable strength. The larger cement tile factories producing from 30 to 100 tons of tile per day are agreed on the use of a mixture of 1 part cement to 3 parts, or $3\frac{1}{2}$ parts at most, of sand, use from 5 to 15 horsepower in pulling the machinery making the tile, use water enough so that watermarks show on the surface of the tile when the jackets in which they are made are removed, and cure the tile in an enclosed room. Usually the room in which the tile are cured is filled with steam supplied at low pressure and run through water to moisten it so as to prevent evaporation. The curing process is usually a matter of three to four days with the temperature above 60 at any rate. After

this period the tile should not be sold under thirty days as they harden rapidly even after leaving the curing room. It is not particularly detrimental for the water in the wall of the tile to evaporate after they have passed through the curing room as the water absorbed by the cement in setting during the first few days is practically all the cement will ever combine with, and subsequent evaporation takes off water that is not needed. A wet, 1 to 3, mixture, hard packed tile will not take in water when sprinkled except on the surface, will give off a metallic ring when struck with metal after being cured, and is a permanent, dependable product.

The main trouble with the manufacturer in general who goes about it to make cement tile on a small scale is that he does not take time and the effort to visit factories that are doing a good business. Let him come up to the standards which large manufacturers have found necessary and he will see that cement tile cannot well be made in a haphazard way nor in small factories with inadequate facilities. Hand made cement tile have been made that are doing satisfactory service and cement tile in general though made with lean mixtures and poor facilities in many, many instances in the past are giving a good account of themselves today. Such good accounts only emphasize the excellent qualities of concrete, but the failures that have shown up should be warning enough not to follow the experimental course that was taken



Grant River Road, One of the Famous Wayne County, Mich., Concrete Roads.

necessarily but a few years ago when the industry was new. The writer has been through the mill when every step was an experiment, but methods are now well established.

Yours very truly,

CHARLES E. SIMS.

Manager, Worthington Concrete Tile Company,
Worthington, Minn.

CONCRETE ROADS

New tools are originated because good mechanics are dissatisfied with inadequate devices that are inefficient, cumbersome, and not fitted for the ultimate good.

Road construction has of necessity had to pass through the stages of precedent to some thing more original and adequate.

Do we not despise the muddy, uneven, undulating, miry, dusty roads, by which progress is hindered, time wasted, anatomies shaken, buggies broken, and brains, by virtue of environment, crippled, maimed, and cramped?



Concrete Road, Hanover Township, Pa. M. J. Malloy, Sugar Notch, Pa., Contractor.

Roadways and the Horse

Think of the wear and tear on our horses! Who among you take the interest on horse investment with their high depreciation into account? True it is that we are reaching the day of the passing of the horse, but do you realize that we have in the United States 25,000,000 horses and mules? It costs almost \$2,000,000,000 to keep them. "What becomes of our \$740,000,000 hay crop?" asks a leading journal—"The horse eats it." "What becomes of our \$334,000,000 oat crop, not to say anything of a large portion of the corn crop?"—"Why, the horse eats it." Yet, notwithstanding this, we make him travel roads which impair his efficiency—our roads make his light loads heavy and the stress and strain tend to shorten his life.

We pay \$500,000,000 to take our produce to market or railroad centers, and could cut this in half, which would mean sufficient funds to build almost 20,000



Concrete Road, Lewis Drive, Waterbury, Conn.

miles of hard surfaced roads or four transcontinental roads, with miles of feeders.

This high cost has been reduced by the introduction of motor vehicles, but even they, too, are working at such low efficiency on the dirt roads.

The more original and adequate roads came in the form of macadamizing. This is a surface composed of angular broken stone in which the voids are filled with stone screenings flushed with water, the whole rolled to a compacted mass.

Roadways and the Automobile

This road unquestionably increased the efficiency of the horse and looked like a favorable disposition of the question, but the advent of the automobile has involved questions of more serious moment, and the roads that were good yesterday become flagrantly inferior today.

Precedent, the enemy of progress, the fetter upon originality, and the shackle upon the daring, must again be overcome and originality predominate.

These macadam roads cost from \$8,000 to \$9,000 per mile to build, from \$700 to \$900 per mile per year to maintain, and it should arouse a spirit of indignation in each one of us; but with an air of complacency we continue in our indifference, wasteful beyond belief.

Will some one rise up and tell us why—why we spend our money in so reckless a manner? If, perchance, the awakening is coming may it be soon, and may we see the passing of the temporary road.

The confirming conclusions adopted by the International Congress state:

1. "The road crust being expensive, it is most important to give it a base which increases its life." A macadam road has no base.

2. "As the weight, speed, and intensity of the traffic continually tend to increase on roads considered worthy of such a crust, it is best to provide a foundation which has been so constructed as to secure the best possible resistance to wear."

The slightest improvement upon a road means it becomes an attraction, and, therefore, means more traffic; so if we improve, let us do it right. An old proverb often quoted says: "If it is worth doing at all, it is worth doing well."

In one of the most able and well-written books pertaining to street construction we find in the summary: "First: That all bituminous streets and roads require as a fundamental prerequisite a solid, unyielding foundation."

Why, again we ask, waste money by the tens of thousands of dollars on initial cost and maintenance just because we always have?

Why not get rid of a bad habit? Start with a concrete base anyway. Concrete roads can be built at a cost of about \$12,800 per mile. Maintenance charges on concrete roads are almost negligible; they are hard, even, most dustless, non-slippery, easily cleaned, and are not hard on our horses, and do not jar loose the nuts on our motors.

Ask the farmer who has driven over them: "Is it hard on the horse's shoulders?"

"No—the surface is so hard and sheds the water so easily that little crown is necessary and the horse can get a full foothold—and when we remember nearly all his initial pull is in one hind limb, it means much to his health and longevity."

"Hard on tires, Mr. Auto Driver?"

"May be a little harder on tires, but my gasoline mileage is greater, can make more time, cover more ground, and my efficiency more than offsets the additional tire cost—besides, think of the comfort."

It is the most durable and satisfactory, is usually laid under the supervision of careful, experienced engineers, under specifications thorough, complete, rigid and exacting.

Would you like to introduce this matter to your town Council? Drop us a line right now and we will forward a copy of "Specifications for Concrete Highway," writes W. A. Fuchs, Advertising Manager, Lehigh Portland Cement Company, Allentown, Pa.

A SIMPLE METHOD OF HANDLING WASHED GRAVEL

In these days of concrete construction with the increasing demand for better and cheaper materials used in the manufacture of concrete the cost of producing sand and gravel suitable for this work plays an important part. With this increasing demand comes the constant struggle of the producer to cut the cost of production without lowering the quality of his product. There are comparatively few pits from which sand and gravel, even under the loosest specifications, may be taken and without further preparation be used in the production of concrete. Most of the specifications require that the gravel and sand be at least screened and many call for a washed product. The means of digging and conveying the material from the pit to the plant by an economical and efficient method frequently becomes a serious problem and in a number of instances has been the cause of abandoning good pits. Hence the necessity of an efficient excavator and conveyor operating in combination with the washing and screening plant.



1. Loaded Bucket Leaving Wet Pit.

A striking example of an efficient and economical gravel handling plant is one owned and operated by Mr. Geo. W. Fife, an Indianapolis contractor. Mr. Fife was awarded a contract by the street railway company for furnishing a mixture of sand and gravel suitable for concrete and ballast work on the road beds. A high grade material was found in the bed of Eagle Creek and the gravel handling plant was located on the railways property adjoining the stream.

The separating plant consists of a simple but substantial frame work of wood about 12 feet wide by 20 feet long and 40 feet high. A heavy bar screen commonly known as a grizzly surmounts the frame work, sloping down in the direction of the bars. As the material is poured over the grizzly, all over size stones roll down the slope of the grizzly and outside of the plant. The rest of the material drops through the bars onto a sloping platform where it receives the water and is forced over another set of screens. The dirt and surplus sand pass through this screen and the bulk of the material which is now of the proper grading and size, passes through a chute directly into cars.

The machine employed in conveying the crude material from the river bed to the screens is in itself an interesting example of efficiency and economy for a gravel plant.

The cableway excavator installed consists of a one cubic yard capacity scraper bucket, suspended from a carriage which travels on an inclined track cable. The bucket and carriage travel down this inclined track cable to the point of digging when the track cable is slackened and the bucket is lowered to the bottom of the creek and is thus allowed to come in contact with the material to be excavated.



2. Loaded Bucket Approaching Screening and Washing Plant.

The bucket is filled by pulling same into the material by means of a pull cable attached to the front of the bucket. When the bucket is filled the track cable is pulled taut by means of a tension mechanism. By tauting the track cable the bucket is lifted clear of the water and it is then hauled up the inclined track cable by means of the pull cable. At the point of dumping an adjustable button on track cable is provided. A traveler block coming in contact with this button dumps the bucket automatically by a continuous forward movement. A two drum hoist operates this excavator. One drum operates the tension mechanism



3. Bucket Dumping Material Into Screening and Washing Plant. Height of Mast, 70 ft.

and the other drum operates the pull cable which loads the bucket and pulls it up the inclined track cable and also dumps the bucket.

The accompanying photographic reproductions show in a comprehensive way the vast utility of the plant as it is a simple matter to move to some other location in connection with contract work.

The cableway is of the Shearer & Mayer type. Mr. Fife was among the first to install this type of equipment and results obtained by him have been highly satisfactory.

Sauerman Bros., 1139 Monadnock Block, Chicago, are engineers and agents for this type of machine.

NEW BOOKLET; CONCRETE PAVEMENTS AND SIDEWALKS

The Universal Portland Cement Company, 72 West Adams street, Chicago, has just issued a new book entitled "Concrete Pavements, Sidewalks, Curb and Gutter." Paper bound, 6x9 inches and contains 96 pages. Sent free upon request to any of our readers. It tells of the uses of concrete in paving, sidewalk, curb and gutter construction. The first section deals with those points which are common to all of these four branches of concrete construction, such as the qualifications of concrete for service, the selection and values of materials for making concrete, and general construction details, including preparation of subgrade, drains, mixing, expansion joints, tools, etc. The second half is devoted to concrete pavement construction, and includes some facts as to service and economy of concrete roads now in use. Materials, equipment and construction methods are described and illustrated. A discussion as to the best type and diagrams showing recommended practice, with a table showing costs and some details of concrete pavements constructed in 1911. The third section, on concrete sidewalk construction, also discusses the various types of work, and shows some failures; describes construction methods and details some costs. Curb and gutter construction is discussed even more in detail and several pages are devoted to the forms for this work.

THE DUST-PRECIPITATING PLANT OF THE RIVERSIDE PORTLAND CEMENT COMPANY, CRESTMORE, CAL.*

After two years of experimenting and with the expenditure of several thousand dollars, a dust-eliminating plant working on the Cottrell process has been completed at the works of the Riverside Portland Cement Company, at Crestmore, Cal. It is claimed that this entirely eliminates the discharge of dust to the atmosphere, the chimney now showing only smoke from burning oil and minute quantities of volatilized potash, which condense on striking the cold outer air (and furnish free fertilizer). Each kiln has a separate double treater on the top of its stack, and any kiln and treater can be shut down without affecting the rest of the system, or the gases from one kiln can be passed through one half of the unit. Each half of the precipitating unit is rectangular, 14 feet high, 12 feet wide and 35 feet long. In the precipitation box is a system of electrodes between which a uni-directional high-tension discharge (60,000 volts) passes. The dust-laden gas enters the precipitation box at a temperature of about 825 degrees F. and a velocity of about 4,000 feet per minute. Once each hour the collecting electrodes are mechanically cleaned of dust which falls into hoppers, is weighed on automatic scales and carried to bins, where it is shipped as filler for fertilizers or asphalt paving material.

Measurements have shown that each kiln stack delivers to its treating box about 5,000,000 cubic feet of gas per hour, carrying about 700 pounds of dust. It is reported that the dust collected yields a revenue more than sufficient to pay for the operating cost of the treating plant, including energy, labor, depreciation and interest.

*From information furnished by the Western Precipitation Co., 1016 W. 9th St., Los Angeles, Cal.

AN ELECTRIC TACHOMETER

There are many operations in which an accurate speed indicator is desired to be permanently connected to an engine or machine, and to show at a glance the speed at which it is running, or to keep a constant record of this speed on a chart for a definite period of time; and in this connection the Brown Instrument Company are placing on the market a new electric tachometer or speed indicator.

An electric tachometer not only has the advantage of being exceedingly accurate, but the indicating or



Fig. 1. Electric Speed Indicator.

recording instrument can be located at any desired distance from the shaft, the speed of which is to be measured. The instrument consists of a small magneto or generator, particularly designed for use with this tachometer, which generates 25 volts at 1,000 r. p. m. Instruments have been particularly designed of unusually high resistance, exceeding 3,000 ohms in each instrument, so that the length of leads connecting the magneto or generator and the indicat-

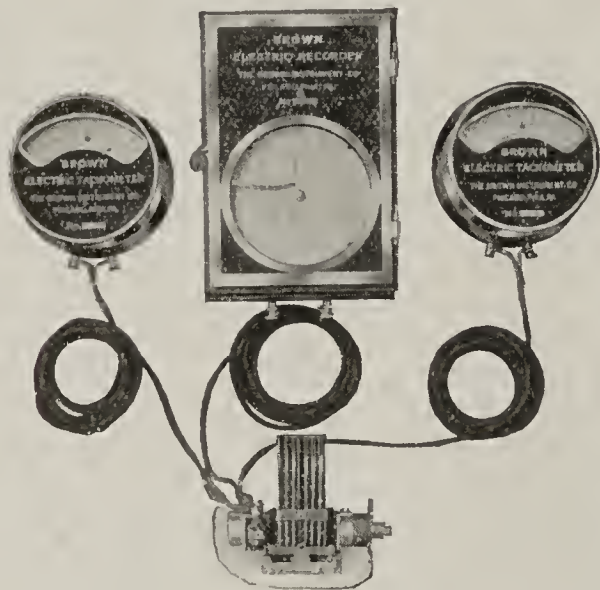


Fig. 2. Generator With Two Indicating and One Recording Instruments.

ing instrument have no effect on the readings, and also one, two or three instruments can be connected to the same generator without affecting the indications. This high resistance feature is exceedingly advantageous, for oftentimes after the generator and one indicating instrument have been installed, it is desirable to place a recording instrument in the office, or at another convenient point, and this can be connected to the generator without recalibration of the instrument.

In Fig. 1 is shown the standard Brown electrical tachometer, generator, leads and indicating instruments as usually supplied, while in Fig. 2 is shown a group of instruments connected to a generator driven by sprocket and chain, two indicating instruments and one recording instrument being connected to the same generator either to indicate or record the speed at three points.

In operating machinery, it is in many instances desirable to know the speed of different parts of the equipment, either to maintain a definite speed or as a matter of record. In the modern scientific analytic study of machine efficiency, such a speed indicator should be of real use.

ECLIPSE UNLOADER

The Galion Iron Works Company have placed on the market a contrivance for transferring stone or sand from cars to wagons that appears to have considerable merit. The fact that the machine is portable suits it to the use of a contractor who is shifting his unloading stations from place to place as his work progresses.

No item of a contractor's expenses is too small to deserve close attention, and the handling of sand or stone is not a very small item—about ten cents a cubic



yard every time it is moved. The old and still the most common way to unload a car of crushed stone is to use men with shovels in the car. Four is about the largest number that can load one wagon at once. The work is difficult until each man digs a place for himself down to the bottom of the car. As soon as he has the flat bottom to shovel from, the rest of his job is easy until the car is empty. The difficulty of this system was much increased when it became the custom to build nearly all cars with pockets in the bottom. When the pockets are small some contractors do not unload them at all, but by making special agreements the weight of the stone in the pockets is counted as gross weight of the car.

The handicap of cars with pockets and bottom doors is converted into an advantage if the car can be unloaded from a trestle or some suitable unloading device is used.

However, the Eclipse portable stone unloader appears to be a step in advance. In order to use it an excavation must be made under the car track. This is not expensive and is not objected to by the railroad authorities. The illustration gives a general view of

the unloader. It consists of a hoisting bucket traveling on skids which extend under the car. Power is supplied by a gasoline engine located under the hopper. The bin or hopper holds two or three loads and has three unloading gates. There is also a chute equipped with a gate through which the material runs from the hoppers of the car into the bucket of the hoist. When the bucket is filled, the gate is closed, and the material hoisted and automatically dumped into the unloader.

"UNIT SYSTEM" CONCRETE FACTORY BUILDING

An interesting concrete building was recently completed for the National Enameling & Stamping Company, of Granite City, Ill., by the Unit Construction Company of St. Louis. This building is a one-story structure, 252x80 feet, to be used for a tin-plate inspection warehouse.

The "Unit-Bilt" method of construction was used in erecting this building. By this method of construction the various structural members are separately molded in forms on the ground, and when thoroughly seasoned, are erected like those of a structural steel building.

The members are so detailed that the reinforcement laps at the joints, and these are filled with a rich cement grout so as to unite all members in the building into a monolithic structure.

From the accompanying illustrations, it can be seen that this method of construction gives a neat-appearing and substantial building, absolutely fireproof and time enduring.

Advantages of "Unit-Bilt" System

The advantage of this method of construction over the ordinary monolithic type is that the members may be made under factory conditions by men trained to their work. The units being poured on the ground, the concrete is readily tamped in the forms and a concrete more homogeneous in texture and uniform in

son from two to four weeks does away with any possibility of failure after being placed in the structure.

The accompanying illustration, showing the interior of this building, gives an idea of the lighting effects obtained by the use of skylights. The skylights are constructed entirely of concrete and wire glass; the glass, being placed at a flatter angle than is usually employed in saw-tooth construction, admits consider-



Exterior of the National Enameling & Stamping Co. Building. "Unit Bilt" Construction.

able more light. The reinforced-concrete, wire-glass type of skylight is of permanent construction, and has been used on various buildings, with very satisfactory results.

A feature that is particularly noticeable in the accompanying illustration of the exterior of this building is the uniformly finished surface. The smooth walls and plain columns make an attractive as well as substantial building.

SAND-LIME BRICK ASSOCIATION CONVENTION

W. J. Carmichael, manager of the sand-lime brick department of the American Clay Machinery Company of Willoughby, Ohio, president of Composite Brick Company, Jacksonville, Fla., and vice-president of the Roux Composite Brick Company, Plant City, Fla., gave a paper entitled "Sand-Lime Brick in the Sub-Tropics," at the tenth annual convention of the Sand-Lime Brick Manufacturers' Association held December 9-10 at Harrisburg, Pa. As the principal owner of two of the most extensive sand-lime brick plants located in the state of Florida, both enjoying a very profitable demand in their respective markets, he was well qualified to talk on this subject. Mr. Carmichael in his connection with the American Clay Machinery Company has installed sand-lime brick plants in Cuba, Mexico, Hawaiian Islands, and several other places in the sub-tropics, and it is his conclusion, drawn from very wide observation, that the sand-lime brick industry is particularly profitable and attractive from a commercial point of view in the sub-tropical regions. The paper reviewed fully the differences of sub-tropical conditions in the manufacture of sand-lime brick as compared with those in more northern latitudes, and it was a very entertaining paper and one of immense value in the files of the association.



Interior of the "Unit Bilt" Factory.

appearance is obtained. The steel is accurately placed and clamped in the forms so that its position is absolutely correct. One of the greatest advantages is the location of joints, which are predetermined by the design; this cannot be done in an ordinary monolithic structure. Another advantage obtained by this method of construction is that all units being allowed to sea-

CONCRETE HIGHWAY BRIDGE, VERNON COUNTY, MO.

The day of wooden floors for highway bridges is rapidly passing and in a few years it will be very hard to find a bridge floor of this kind. Probably there is no condition under which wood will deteriorate more rapidly than when used for this purpose. The floors of highway bridges are not only exposed to all kinds of weather conditions, but are subjected to a constant wear from passing vehicles. The usual practice has been to construct these floors of three inch planks, and under ordinary traffic conditions it is necessary to replace them every three years. This means a considerable expense for repairs without considering the inconvenience to those using the bridge during the time of repairing.

New highway bridges of the type illustrated on this page are being constructed with reinforced concrete floors, thus eliminating all of the troubles mentioned

COMMITTEE INVESTIGATING TITLE

Committee C6 of the American Society for Testing Materials held a four-day session at the engineering experiment station at Ames, Iowa, and at the cement tile plant of A. S. Tanner, at Jefferson, Iowa, the middle of October. This committee has been for some time investigating the matter of pipe and tile preparatory to formulating standard methods for testing these products, and to accumulate test data on which such standards could be based.

This recent meeting of the committee was designed especially to give the members an opportunity to see in operation the various testing machines which have been proposed for this class of work. Ten specimens in each of several different sizes were broken by the committee, both in clay and cement, and a sub-committee was left to continue the work until a sufficient number of specimens had been broken to give a reliable average.



Concrete Highway Bridge, Vernon County, Mo. Engineer, Jas. M. Clack, Nevada, Mo.

above. The first cost is a little more than that of a wooden floor, but it is the last cost.

This floor is four inches thick, reinforced with "ECONO" expanded metal and carried by ten inch steel I-beams.

CAR UNLOADER

The Link Belt Company, Philadelphia and Chicago have recently placed upon the market a car unloader, built either movable or stationary. Two or three men will unload a car of loose material at the rate of 50 tons per hour, at a cost of $1\frac{1}{2}$ cents per ton, as compared with employment of 8 to 10 shovelers at a cost of from 8 to 10 cents per ton. The machinery consists of a heavy elevator on a steel frame, hung on the end of a boom, which may be lowered and raised in and out of the car by means of a wire rope and winch. The material, fed to the buckets by shovelers in the car, is delivered by means of a steel spout to a second fixed elevator which fills the bin. The distinct advantage of using two elevators is, first, it decreases the weight of the hinged part, and second, the material may be spread on the ground at each side of the pocket as a reserve storage, if possible. Prices, blueprints and all necessary information will be mailed, free of charge, on request. Mention Cement & Engineering News when writing.

All members of the committee except one were present either in person or by proxy.

Arrangements were also made to carry still farther the absorption and freezing tests which have been begun at the University of Wisconsin.

CONCRETE COAL BINS

It is rather strange that cement, which is one of the cheapest of all commercial commodities should be used extensively for the protection of the next cheapest commodity—coal. Several thousand barrels of Universal Portland cement were used by the Indianapolis Light & Heat Co., in the construction of a huge box 100x300 feet and 34 feet deep in which to store over 30,000 tons of coal. This is a somewhat new development but it has been found that coal loses considerable in heating value when stored in the open and furthermore that spontaneous combustion is almost impossible to prevent when coal is stored in large piles. The storage in concrete pits makes it possible to keep the coal under water from the time it is received at the plant until ready for use, and while it adds somewhat to the expense of operation yet it is insurance against loss.

INDUSTRIAL NOTES

The Armstrong Mfg. Co., Waterloo, Ia., is receiving many foreign orders for its products. It has received a tender from the Russian Geological Survey covering a period of three years. Other assured foreign business for 1914 is stated to aggregate \$500,000 provided prompt deliveries can be made. The company will at once begin the building of an entirely new plant for the manufacture of blast hole drills.

The Vulcan Iron Works, Wilkes Barre, Pa., have just issued a new and artistic, well-arranged catalogue, cloth bound, 6x9¼ inches, containing 160 pages. The illustrations show types of locomotives in general use and designed for a wide range of service and for all practicable gages of track. Also calls particular attention to the special steel works and gasoline locomotives. The data relating to dimensions, weights, etc., are conveniently arranged in tables accompanying the photographic reproductions and specifications and a considerable amount of general railway engineering data are found in the latter part of the catalogue. Vulcan dinkey locomotives are being used by the leading cement, crushed stone and gravel and sand companies throughout the United States, Canada and Mexico.

MANUFACTURE OF LIME

Technologic Paper No. 16 of the Bureau of Standards has been issued by Warren E. Emley, assistant chemist of the Bureau of Standards, Washington, D. C. The object of this paper is to correlate and to compare the equipments of various plants and processes with special reference to economy of operation and quality of the finished product. The paper includes a general discussion of lime, its manufacture and uses. Two or three typical plants distributed through various parts of the United States were visited. A general description and photographs of these 19 plants are given in an appendix to the paper. The processes of the manufacture of quick lime and hydrated lime are discussed in detail and include a discussion of heat utilization and efficiency.

BRADLEY HERCULES THREE ROLL MILL.

Announcement is made by the Bradley Pulverizer Company, Boston, Mass., that they have decided to call their new mill the Bradley Hercules Three Roll Mill instead of the Bradley "66" Three Roll Mill. In this connection the company state that the installations which are now in operation are continuing their exceptional work which is most wonderful. While it is not surprising, it is most gratifying to us, writes the Bradley Pulverizer Company, to note the great interest which is being taken in this new preliminary pulverizer by cement manufacturers.

CONCRETE SILOS

A company with a capital stock of \$150,000 is being organized at Bay City, Mich., for the purpose of manufacturing silos of concrete blocks. Alex. Zagelmeyer, of the Zagelmeyer Cast Stone Block Machine Company, is at the head of the proposed organization. It is proposed to locate the plant either at Oxford, Mich., or Lansing, where the company will have easy access to a gravel pit, thus avoiding heavy freight bills on material. The blocks for the silos will be cast in segments to permit the construction of silos in circular form.



Inertia

The resistance to motion, we are told, is the bane of industrial progress—the inability of men to grasp fully their opportunities. But where absolute confidence reposes in the adviser we are loath to believe this can be generally true.

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Elevator Belt	Packing
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TISCHER'S CREEK BRIDGE, DULUTH, MINN.

An interesting and a comparatively new type of bridge construction is shown in the accompanying views. It is of the Tischer's Creek bridge, spanning a small stream in the city of Duluth and carrying the Superior bridge traffic.

It will be noted that the bridge consists practically

trestle bents as centering for the new concrete work. There was almost enough timber in the upper structure to make all necessary forms and supports. When one-half had been completed and set it was thrown open to traffic, and the remaining half built.

The test required by the engineering department of the city of Duluth, required that two construction



Tischer's Creek Bridge, Duluth, Minn. Geo. H. Lounsberry, Contractor.

of a flat slab supported by three parallel rows of octagonal columns carried down to rock foundation. The bridge was built under rather difficult conditions. An old trestle had carried the traffic, but required renewal. A permanent concrete structure was designed by Mr. C. A. P. Turner of Minneapolis, Minn., using the mushroom system of construction, in such a way that traffic could be carried on one side of the old trestle during the construction of the concrete bridge on the other side. The usual high cost of centering was greatly cut down in this case by the use of the old

cars heavily loaded with steel rails be run over the structure. The resulting deflection was almost negligible.

The use of the flat slab in bridge work was in this case very economical, due to the saving effected in the cost of centering. This will probably be true in many cases where wood trestles are to be replaced, as only slight modifications are sufficient to change the old structure into suitable centering.

The Cherokee-Girard Coal Company of Minden Mines, Mo., have recently purchased a model 250 Marion steam shovel with a 75 foot boom and a $3\frac{1}{2}$ yard dipper, for stripping and loading coal at the coal mining fields at Pittsburg, Kans.

We want to buy good second hand steam shovels, screens, conveyors, etc., to work sand beds. Address Imperial Cement Block Co., 305-307 Gurney Bldg., Syracuse, N. Y.

FOR SALE.

At the junction of two trunk lines of railroad in Michigan, four hundred acres of high grade marl land. Thoroughly proven as to quantity and tested as to quality by Prof. Edward D. Campbell, chemist University of Michigan. Marl runs 4 to 15 feet deep. Address Oliver M. Martin, Trustee, Ann Arbor, Mich.



Reinforcing in Place, Ready for Concreting. Tischer's Creek Bridge.

FINENESS DETERMINATIONS IN CEMENT

In regard to the letter of Mr. Bernard Enright, director of the Eastern Testing Laboratories, Allentown, Pa., which appeared in the October issue of Cement & Engineering News, we would state that in our own practice we have failed to note as marked discrepancies in comparative tests with different standard No. 200 sieves approved by the Bureau of Standards as stated by Mr. Enright, although we have not had occasion to make very careful study of the matter.

It has been recognized by all testers of cement that the sieve test is at best only a make-shift and subject to errors, both from the character of the wire cloth and the personal equation involved in manipulation by different operators, and also because the sieving test fails to give a true indication of the amount of fine flour contained in the cement.

Taking up Mr. Enright's suggestion that the sieves be standardized by passing through them carefully prepared material of predetermined fineness, as well as by measurement of the wire and count of the mesh, we would state it has been the practice in our laboratories for a number of years to subject the sieves to a test along lines similar to those suggested by Mr. Enright. Noting, some 12 years ago, the great variation in the sieves then made, we ordered shipped us one dozen sieves, which were carefully tested, using the same material. A sieve was then selected which gave results closely approximating the mean of the twelve sieves under test. This was taken as our standard sieve, and by continuing the practice of ordering a number of sieves at a time and keeping only those which gave results closely approximating the sieve first selected, we have been enabled to keep our own results over a period of years closely comparative.

With the introduction of the sieves approved by the Bureau of Standards, this practice was dropped, but from the results obtained we believe the adoption of the suggestion of Mr. Enright would tend to insure greater uniformity between various sieves put on the market. We would point out, however, that the sieve does not remain constant, and its coefficient of correction would change with use.

Henry S. Spackman Engineering Co.,
Henry S. Spackman, President, Philadelphia.

LIMESTONE PULVERIZING

The Bradley Pulverizer Company, Boston, Mass., advise us that they have just sold a Bradley Three Roll Mill installation to the Stearns Lime Co., Danbury, Conn., for the purpose of pulverizing limestone for agricultural purposes. The Bradley Three Roll Mill is now recognized as the most economical mill for this purpose. It produces a very finely powdered finished product which acts very quickly on the soil and makes a product that is very saleable.

It has been the idea of a great many limestone producers that fine pulverizing has been too costly, but by the use of our mill it has been demonstrated that the finely ground product can be secured more economically than the coarser product of other mills.

They have also received an order from the American Agricultural Chemical Co., Lazaretto Works, Baltimore, Md., for a Bradley Three Roll Mill installation for pulverizing phosphate rock to be used in the manufacture of fertilizer. This mill is looked upon as the standard phosphate rock grinder of the country. It gives the necessary fineness at a minimum cost, has a low horsepower consumption and is easily operated.

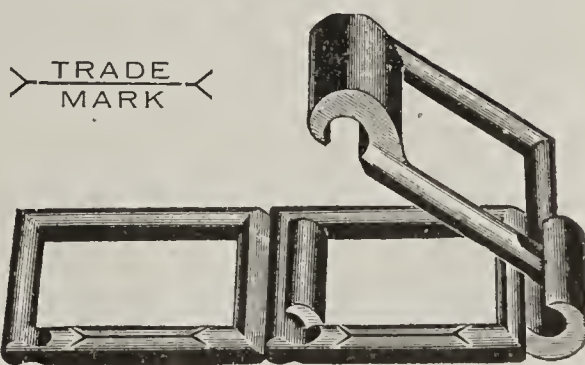
LINK-BELT

Manganese Steel Chains

Combined with **>FLINT-RIM<** wheels, make an ideal combination for *durability* and *service* in the handling of abrasive materials, such as cement clinker, ashes, crushed stone, ores, fertilizers, etc.

Manganese steel is famous for its *toughness* and *hardness* to resist wear, and special processes, mixtures and heat treatments have made it possible to furnish smooth and uniform chain links of the various types used for severe work.

Prices on our many sizes and styles furnished on request.



Write for the following Link-Belt Catalogs:

- No. 90—400-page General Price List Catalog.
- No. 124—Link-Belt Steel Chains.
- No. 185—Ewart Detachable Link-Belt Price List.
- No. 108—**>FLINT-RIM<** Sprocket Wheels.

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San Francisco.....The Eby Machinery Co.
New Orleans.....Wilmot Machinery Co.
Los Angeles.....204 N. Los Angeles Street
Minneapolis.....Link-Belt Supply Co.
Birmingham.....General Machinery Co.



TUNNEL BLASTING IN STONE QUARRY.

Mr. A. H. Craney, vice president of the St. Louis Portland Cement Company, wrote us recently regarding an interesting and successful blast that was made at their quarry in St. Louis by experts sent out by the Du Pont Powder Company of Wilmington, Del., to demonstrate the efficiency of tunnel blasting. A place at the great quarry was selected where a practically perpendicular face of rock was exposed, approximately 500 feet long. A tunnel was mined out at the bottom of the quarry face, as shown by the opening in illustration herewith, and after tunneling in for about 50 feet, laterals in both directions were drifted out from the tunnel and dynamite deposited in the resulting gallery. The mouth of the tunnel was then closed up with rock and earth and a battery connection was effected. The pile of empty boxes shown in cut on this page illustrates the volume of the charge, there being 118 boxes of dynamite.

When all preparations were completed, from a safe distance the explosive was worked and the exploding dynamite in the gallery below ripped out the quarry face resulting in a tremendous fall, as shown in picture herewith. This blast was made the latter part of last July and two Marion steam shovels, manufactured by the Marion Steam Shovel Company, Marion, Ohio,

case a soft stratum just at the right level with that part which is the expensive part of tunneling reduces it to a minimum cost, so that the tunnel of the Kansas City plant is really cheaper than the average open-face quarry.

These factors in connection with quarry operations, which are a large part of the initial expense of the production of Portland cement, have been studied out and applied effectively in the two plants which are under the direction of Mr. Craney's skillful management.

ABBE ENGINEERING COMPANY

The Abbe Engineering Co., 220 Broadway, New York, has purchased the Sellman Mill Co. and the pulverizing and grinding machinery business of G. M. Ball & Son, together with all the patents, drawings, patterns, good will, etc., of the foregoing concerns. Henry Sellman, who has been building pebble mills and installing complete grinding plants for the past 34 years, is now with the Abbe Engineering Co. in its engineering department. The Abbe Engineering Co. states that it now controls over 30 patents on various kinds of pulverizing and grinding machines.

THE VAN DUZEN CONCRETE MIXER.

On account of the weight of the materials, the mixing of concrete has always been one of the places where the



QUARRY OF ST. LOUIS PORTLAND CEMENT WORKS: FIG. 1. FACE OF QUARRY BEFORE BLASTING, SHOWING 118 BOXES OF DYNAMITE; FIG. 2. RESULT OF TUNNEL BLASTING.

were kept constantly busy in gathering up the rock up to the middle of December. Another similar blast is being prepared at the present time.

In speaking of quarry operations, Mr. Craney turned to the character of their work at the Kansas City plant, the St. Louis Portland Cement Company, also own and operate the Kansas City Portland Cement Company of Kansas City, Mo. In this instance they have an open-face quarry close to the railroad, and this quarry operation has always been carried on by the tunnel process. The peculiarity of the rock formation is a seven foot stratum of soft material which occurs at exactly the right level for the drifting of the tunnel economically, and the steam shovel used at the plant is equipped with a tractor as that it travels into the tunnels to load the quarry cars which come out with the product of the mining operations that are carried on in the farther end of the tunnel.

The tunneling arrangements at the Kansas City plant, as assisted by nature, is a very economical method of quarrying the limestones for cement-making purposes. A large part of the cost of quarry tunneling in other places has been found to be the top opening of the tunnel. It is simple enough to blow out the lower levels of the tunnel after a floor is established to stand on and work on. It is carrying out the top of the tunnel holes that makes the expense. In this

contractor tries to save on his labor. To turn a ton of stone, four or five hundred pounds of sand, two or three hundred pounds of cement and water, over three or four times requires a lot of shoveling, and when you are through it makes about a yard of concrete, which must still be wheeled or shoveled into place.

It is, therefore, no wonder that the contractor tries to satisfy himself with turning the mass over once or twice and calling it a mix.

Everyone knows this is not the right way to do, but when they do not have a mixer, the tendency is to get the work done as quickly and as cheaply as possible.

The Van Duzen Concrete Mixer made by Van Duzen, Roys & Co., 341 Dublin avenue, Columbus, Ohio, is designed to perform the work of mixing quickly and economically. As generally arranged, the mixer is provided with a gas engine of suitable size to turn the drum and operate the other necessary machinery. The mixer is so arranged that it will discharge directly into a wheelbarrow standing on the ground beside it, thus saving in the labor of putting the concrete in place.

The Van Duzen Mixer is made in a number of styles and sizes to suit the needs of various contractors. A catalogue describing these mixers shows their construction in detail as well as gives other valuable information to the contractor.

THE MODERN METHOD OF CRUSHING ROCK

Did you ever take the stem of a match and stamp on it, you can flatten it out if you stamp hard enough. Now take another piece and roll it under the foot. With half the effort it is ground to shreds. We apply that same motion the rolling of material along a stationary surface, to the Universal "forced-feed" crusher, writes the Universal Crusher Company, 304 North Third street, Cedar Rapids, Iowa. That's where it gets the name "Forced Feed"—so you can see right away that we have a right to claim a bigger capacity for our crusher with the same or less horse power.

In a gravel pit most of the material dug from the bank is damp and slippery, sometimes wet and muddy. That's mean stuff to crush. Did you ever see a piece "pop" out of a crusher and fly twenty feet in the air. It is not at all uncommon with the old type crusher. But in a machine like the Universal it can't do this. It is dragged into the machine by the same pushing, rolling motion of the movable jaw that crushes it so easily and so fast. It can't clog no matter how wet it is. It just simply has to go through.

Now in a machine with a motion like this gravity doesn't cut much of a figure. In old style crushers the rock drops away from the jaws, but in the Universal Forced Feed Crusher, it drops away at a rate that makes you wonder how it is done. It is forced through and away from the jaws.

That is the kind of crusher you need in your plant. It can't be broken because its strength is figured on the basis of five times the load it will ever have to crush. You could stall an engine of five times the required horse power before any part would give away. And the chances are that the safety toggle plate behind the movable jaw would be the only thing that would give. That can be replaced in about three minutes time and at a trifling cost.

Grasp for a minute these points of distinct superiority. Open hearth steel frame, nickel steel shaft, manganese steel jaws, replaceable phosphor bronze bearings, and the smoothest, coolest running proposition with two wheels. This machine has come to stay. Twenty years of manufacturing experience are represented in these crushers. There are sizes for every imaginable purpose, some with capacities as small as a ton an hour and some that will crush forty tons an hour. In every machine you find the feature of adjustment to crush to any size. That in itself is worth a good deal in a gravel plant. Send for our Folder No. 10, which contains valuable information on crushing. The Universal Crusher Co., Dept. 14, Cedar Rapids, Iowa. Mention Cement & Engineering News when writing.

PRACTICAL CEMENT TESTING

A new book entitled "Practical Cement Testing," by W. Purves Taylor, M. S., C. E., engineer in charge of Philadelphia municipal testing laboratories, has just been issued. This is the first practical and exhaustive treatise on this important subject. It has already been adopted as a text book by the University of Pennsylvania and other technical schools. Each chapter contains a minute description of the methods followed in the author's laboratory and many valuable suggestions as to the "how" and "why" of cement testing. The observations on the interpretation of results, one of the most difficult tasks of the novice, are especially pertinent and are expressed in a fair and conservative manner.

Cloth, 6x9 inches, 330 pages, 142 illustrations, 58 tables: \$3 net, postpaid. Sent upon request by Cement & Engineering News, 1117 Schiller Building, Chicago.

The Negley Patented Excavator

Performs All Slack Cableway Operations

It has the fast and the slow dumps combined in one machine. It can be dumped at the anchor end of the cable-way. It only requires $3\frac{1}{2}$ feet for clearance, giving good storage. It dumps without extra power, and with no stress on equipment. It operates with the minimum of working pressure, efficiently. It is a standardized machine, having no expensive special parts. It has a carriage, which is rigidly connected to the bucket. It has a two-piece bucket, open on the top, and easy to load. It deposits the material close to the power mast or tower.



This picture shows our excavator operating in Iowa, where it is doing efficient and economical work, loading cars for shipment.

Several kinds of equipment has been used by this operator, but this machine is giving the best results he has yet obtained.



The above picture shows the Negley Patented Excavator at work in Indianapolis, operating on boulevard construction, where four of these machines are employed, this one being equipped with a bridle, as the material runs shallow, and frequent changes are necessary in shifting the anchor end of the cable-way.

This demonstrates the broad adaptability of this excavator, to all conditions of excavation, where the slack cable-way system can be used.

See Us at the

CHICAGO CEMENT SHOW

Indianapolis Cable Excavator Company

New York Street and Beauty Avenue

INDIANAPOLIS, INDIANA

SPEED REDUCING TRANSMISSIONS

In order to secure the best and most economical operation of machinery, motor users are beginning to realize the fact that open back gearing, chains and belts often prove a most undesirable means for reducing the motor speed; particularly on account of the usual upkeep expense necessarily involved, the general inefficiency, as well as the large amount of space installations of this kind require. Open gearing of this sort has often proven decidedly objectionable in brick plants, cement plants, coal mines, excavation work, steel mills and other industries of a like nature, where more or less dirt and grit are constantly getting into the gearing, causing excessive wear, requiring but a few months in some instances for their total destruction.

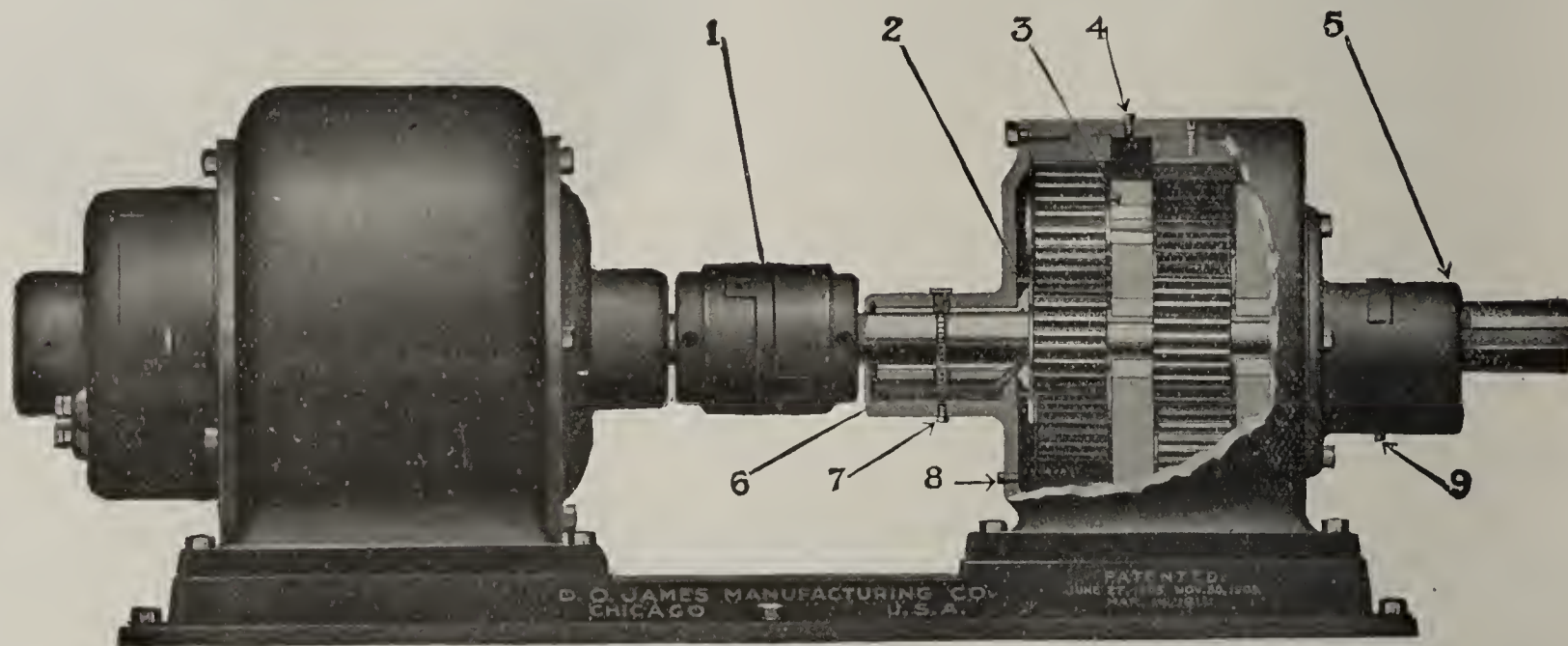
The O. K. Speed Reducing Transmissions manufactured by the D. O. James Manufacturing Company, 1120 West Monroe street, Chicago were designed with a view to eliminating the many undesirable features in evidence in other forms of power transmission, and it is with no little gratification that we look over

and durable, being entirely incased and oil tight, as well as dust and fool proof. All moving parts travel in the same direction, and you will note by taking power from three points of the king pinion it gives a well balanced drive of great emergency strength.

Motor users have long recognized the desirability of a drive with which power could be taken from the motor without the usual one-sided strain caused by the use of the ordinary gear and pinion, pulleys and belts, sprockets and chains. O. K. Speed Reducing Transmissions relieve the motor of this one-sided strain and allow it to run under most favorable conditions.

We are prepared to furnish the O. K. Reducer mounted on a cast iron bedplate with motor as shown, to give any desired slow speed. This style makes a very desirable unit, as motor and reducer are always in absolute alignment.

When writing for prices state horsepower and voltage, also driven speed required, and if alternating current state cycle and phase. If the user wishes to furnish his own motor, we will gladly quote price for



MODEL B REDUCER

1. Universal coupling with steel center piece.
3. Casehardened forged steel pins.
5. Note absence of stuffing boxes on both bearings.
7. Oil chamber drain plugs.

2. Patented oil groove and disk, obviating necessity of stuffing boxes.
4. Oil intake plug.
6. Note large oil chamber.
8. Oil overflow gauge.
9. Oil chamber drain plugs.

our long list of well pleased users, who can testify as to the particular merits of this drive.

In the O. K. Reducer, writes Mr. James, we have aimed to produce a speed reducing mechanism of the highest order, one which will stand the test of time and stand up well under heavy duty and most trying service. In the past few years we have gained considerable experience as to the special requirements of many different kinds of installations, and we are better than ever prepared to furnish a Reducer which will meet the particular requirements at hand.

The day of the individual motor drive is here, and the need of a first-class speed reducing mechanism becomes readily apparent. By a first-class speed reducing mechanism, we mean a transmission whereby the speed of the motor may be reduced in a most efficient, compact, as well as durable way; a means by which the gearing may operate under ideal conditions, free from dirt and grit.

All the above features have been embodied in the O. K. Reducer, and one more point we wish to mention is the absolute safety of the drive. No gears are exposed, thus the possibility of an employe getting hurt is entirely eliminated.

O. K. Speed Reducing Transmissions are made in a variety of sizes and speed ratios, ranging from 4:1 up to 1600:1 or more. They are highly efficient, strong

Reducer and bedplate only, with pads planed off ready for mounting the motor; or if motor is shipped to our factory we will see that the complete outfit is properly mounted.

One of the best evidences as to the general endorsement of the drive is the repeat orders we receive from time to time from large concerns who have found through actual test the advantages of using an up-to-date drive of this kind.

We have a great many well pleased customers who are using the O. K. Reducers for heavy duty and continuous service, operating in some instances day and night for months at a time with practically no stop.

The O. K. Reducers are used extensively by many concerns for operating large drums at very low speeds, such as driers, cereal cookers, cement mixers, etc. Paper mills find the drive particularly desirable, and in view of the fact that the gearing is entirely inclosed and operating in oil, it makes these devices especially adapted to lime, crushed stone, gypsum and gravel plants, as well as cement mills, or in places where it is necessary to keep the gearing free from dirt and flying chips.

For use in connection with conveying and hoisting machinery the O. K. Reducer is unexcelled. It has been used with car loaders and car pullers; also in connection with freight and passenger elevators, or for driving grain elevator legs.

BRINGING DOWN 100,000 TONS OF CEMENT ROCK WITH DU PONT POWDER.

This picture was taken at the quarry of the Alpha Portland Cement Company, Martins Creek, Pa., at the time of firing 10½ tons of Du Pont dynamite loaded in thirteen 6-inch holes bored 170 feet deep, down the entire face of the quarry. 100,000 tons of rock were dislodged by this blast. The "Clipper" Blast Hole Drills, manufactured by the Loomis Machine Company, Tiffin, Ohio, were used in drilling these deep holes.



CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

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or two years for \$1.50, 3 years for \$2.00. All other countries,
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Advertising Manager

CHICAGO, MARCH, 1914

HYDRATED LIME

The use of hydrated lime in modern building construction is making rapid headway upon its merits. While it is comparatively new in this country, it has been almost in universal use in Europe for the past thirty years, as architects, engineers and building contractors prefer it to ordinary slacked lime on account of its greater reliability. In fact, all specifications governing building operations nowadays demand its application abroad, as good work can be expected to be done only with lime thoroughly hydrated for a long time prior to use. The use of quick lime therefore is found to be abandoned almost entirely in England, Germany and France.

In several of the European countries large corporations have grown up which prepare and deliver hydrated lime mortar to contractors on the job in properly mixed and well seasoned condition, so that the contractor saves the time and labor of slaking the burnt lime and that the architect's specifications are fulfilled which call for a uniform and perfectly hydrated mortar.

Hydrated lime is as safe and better than many of the patent plasters now on the market, which is saying a great deal. Its application removes the serious objection of swelling and expanding of the finished wall, which often happens if ordinary quick-lime is used. A good illustration of the danger of using lime, slacked on the premises, is the following instance, which can be duplicated a hundred times at every moving season, in which a handsome dwelling was plastered on the inside with ordinary lime mortar, slaked immediately before use and placed on the wall in short order. The

owner had moved in and had arranged everything in perfect order with a view to give a house warming and to receive his guests, which he and his wife met at the suburban station at an appointed hour. The guests arrived and were being conducted into the house, which the owner had left neat and trim a few minutes before. On opening the door, they found the carpets, rugs and chairs covered with a mass of broken plaster. The piano which had been left open was likewise found completely covered with lime plaster which had swollen and could not possibly adhere to the wall. Had hydrated lime mortar been used this could not possibly have happened.

The burning and hydrating of lime is found to be a profitable business, especially in the neighborhood of the large cities, where a great deal of building is going on the whole year around, and in localities where a high grade of limestone is found which must be free from magnesia and other substances. The processes of burning and hydration are simple, do not require much machinery and can be started with comparatively small capital, about the only additional requirement being competent supervision of the process of manufacture.

BUILDING THE ARROWROCK DAM

The most extensive piece of concrete construction now in progress on the work of the U. S. Reclamation Service is the Arrowrock Dam in the Boise project in Idaho, and the other works which supplement it. This dam is of rubble concrete of a maximum height of 351 feet, its length 1,060 feet, and will when completed, contain 530,000 cubic yards of concrete. The thickness of the base is 240 feet and the width at top 16 feet. The foundation is about 80 feet below the bed of the river. It might be mentioned incidentally that in connection with this is the Arrowrock diversion tunnel, 487 feet long and with a cross section of 25x30 feet.

An interesting feature in connection with the Boise project is the main canal heading about eight miles from Boise, and extending down the valley twenty-four miles. It is the largest canal built by the Government, having a carrying capacity of 2,700 cubic feet per second.

One of the interesting features in connection with this work is the fact that sand cement is being used, the blending of the sand with the cement being done in a plant installed for the purpose right at the works, this plant having a capacity of 1,000 barrels per day of 24 hours.

At this plant the sand cement is made by blending of ordinary Portland cement with about an equal amount of pulverized granite. The granite is obtained from the spillway excavation, and is run through the rock crusher and sand rolls, then through a rotary dryer and into the ball mill, where it is pulverized to pass the 20-mesh sieve. It is then mixed with the Portland cement and ground with it in three 5x22 foot tube mills to such a fineness that about 95 per cent passes the 200-mesh sieve. The resulting product is claimed to be as strong as the original Portland cement.

Much of the excavation in the construction of the dam is being done by a 70-ton steam shovel equipped with 2 and 2½ cubic yard dippers. A drag-line excavator with 2½-yard bucket and 70-foot boom is also in commission, and four 10-ton stiff-leg derricks and two 16-ton locomotives made by Vulcan Iron Works, Wilkes Barre, Pa.

The rock is crushed in two No. 5 Austin crushers, manufactured by the Austin Manufacturing Company, Chicago, Ill.

Patents Relating to Concrete Construction

By Walter M. Denman

From 1890 to 1900 inclusive approximately thirty-five patents were granted on concrete construction, an average of but three or four each year. In the next 5 years about 125 patents were granted in this branch; but during the past 6 years upward of 800 more have been issued, and the number now issued each year approximates 150, or about three each week. Some of these have been pushed actively, and in order to indicate to designers what features of concrete design are covered Mr. Walter M. Denman, of Springfield, Mass., presented a summary of these patents before the American Concrete Institute.

The large majority of these patents have never been commercially successful, many of them having been granted to individuals who have no conception of the patent laws or of the methods of commercial exploitation of patents. To such an owner a patent is of no value. The purpose of a patent is to limit competition during its life, and it must be enforced through due process of law or it is useless. It must, therefore, insure to its owner a sufficient return through increased efficiency through its use and to furnish enough protection against competition to warrant the expense of litigation.

Features of Concrete Patents

One remarkable fact stands out prominently in the history of concrete patents. It is that all of the concrete patents which have been commercially successful have been made so by the patentees themselves and that each of these patentees is an engineer by profession. This is in very marked contrast to the stories current of indigent inventors, and also contrary to the accepted view of the commercial ability of the average engineer.

Another noteworthy fact is that each of the patentees has succeeded by applying himself to a particular engineering structure. With one or two exceptions he is the only patentee who has made a commercial success of patents in that special field. This feature is of special interest to the designing engineer, who thus has but one line of patents either to employ or avoid in the design of any particular structure. In order to convey an idea of the present status of the patents, each general type of structure will be taken up, and it will be found that the commercially successful patents are owned by the following patentees:

Bridges: Daniel B. Luten, Indianapolis; F. Melber, Pittsburgh; Thacher & Mueser, New York.

Buildings: E. L. Ransome, New York; C. A. P. Turner, Minneapolis.

Dams: N. F. Ambursen, Boston.

Retaining walls: Frank A. Bone, Cincinnati.

Sewers: W. C. Parmley, New York.

All the above patentees seem to be actively engaged in enforcing their patents and to infringe them renders the infringer liable to damages and costs far more serious than the nominal royalty usually charged for a license. The following notes describe many of the more important patents covering the various types of structure, together with such of their legal history as has been gathered:

Bridges

Luten Patents.—The Luten patents on concrete bridges are twenty-six in number, most of them having been granted within the past 5 years, so that they will average 12 years of life. Among the more interesting is No. 1,009,676, granted Nov. 21, 1911

(application filed April 29, 1901), the strongest claim of which reads: "In an arched structure of concrete the combination with a curved or arched member and abutment to support same, of a series of tension members embedded in said curved or arched member, and passing close to the interior faces of the abutments." This patent is interesting in that it was applied for in 1901, a year in which but six patents were issued for concrete work. Under this patent one decree has been granted finding the patent valid and infringed.

Luten patent 818,386 issued April 17, 1906 (application filed in 1902). Its prominent claim reads: "An arch having embedded therein rods, bars or other tension members in two or more series following one face of the arch rib thence across and following the other face of the rib, the points of crossing for the different series being angularly or laterally displaced with respect to each other." This patent was applied for in 1902, a year which saw the issue of but eleven patents. Six decrees have been obtained under it by the patentee with perpetual injunction and damages, the patent being held valid.

Luten patent 840,224, issued in January, 1907, the principal claim of which is as follows: "An arch or bridge having the bed of stream paved with concrete with tension members embedded transverse to the course of the stream." This patent has been through the courts twice with decrees of validity.

Luten patent 830,483, issued Sept. 4, 1906: "A structural member of concrete reinforced with main members of low-tension metal and with secondary members of roughened, high-tension metal." It will be noted that this claim may apply not only to a bridge but also to a beam, girder or floor of reinforced concrete, and this feature characterizes many patents. Under this patent two decrees have been issued finding the patent valid and infringed.

Luten patent 853,203 issued May 7, 1907, and applied for in 1902, the principal claim of which reads as follows: "A bridge of concrete or similar material with reinforcing bars embedded transverse to the roadway in combination with a wall or spandrel with upright reinforcing members embedded." This patent has been declared valid and has been infringed in eleven cases, with injunctions and damages obtained against the infringers.

Luten patent 852,970, issued May 7, 1907. This patent has two important claims:

"A bridge or arch of concrete or other suitable material, having a pavement in the bed of the stream with an apron or a sheeting of piling or other suitable material to protect against undermining." "A bridge or arch of concrete or other suitable material having spandrel walls and a wing or wings reinforced with embedded rods joining the wings to the spandrel wall."

This patent has been declared valid and infringed in nine separate suits.

Luten patent 1,004,051, issued Sept. 26, 1911, the important claims of which read:

"A plurality of skew arches supported on a plurality of piers, each having its sides inclined with respect to each other."

"An arch with a face inclined to its axis and reinforced with embedded tension members substantially normal to its face."

This patent has been declared valid and infringed in one suit.

Luten patent 923,058, issued May 25, 1909. The

gist of this patent is in Claim 14: "That improvement in the art of building an arch or girder comprising erecting the arch or girder together with part of the spandrel or superstructure on centers then lowering the centers and subsequently adding coping or railing."

Luten patent 802,004, issued Oct. 17, 1905. "An arch or similar centering comprising columns or uprights too light to alone carry the weight of the arch without bending and removable sway-bracing for said uprights." This patent has been declared valid in one suit.

Thacher and Mueser Patents.—Messrs. Edwin Thacher and William Mueser of New York have been granted four patents on concrete bridges, besides several patents on Thacher deformed bars and Mueser's diamond bar. Typical of the bridge patents are the following:

Thacher patent 617,615, issued Jan. 10, 1899. The principal claim in this patent seems to be: "The combination with abutments and a concrete arch spanning the space between the abutments and a concrete arch spanning the space between the abutments, of a series of metal bars in pairs, one bar of the pair above the other bar, near the extrados and intrados of the arch, each bar of the pair being independent of the other and one bar of each pair extending well into the abutment, substantially as described."

Mueser patent 731,595, issued June 23, 1903, is described as comprising the following: "In a bridge or viaduct comprising a spandrel wall, a concrete steel sidewalk made in slabs and centrally supported along the top of the spandrel wall." No decrees have been handed down under the foregoing patents, but numerous suits are in immediate prospect.

Melber Patents.—Mr. Frederick Melber, of Pittsburgh, has been granted six patents on concrete bridges and concrete construction.

Melber patent 660,518, granted Aug. 23, 1900. In this patent the following claim is the strongest. "In cement or other concrete structures, metal reinforcing bars, unattached at their ends to other metal reinforcing bars, embedded therein transversely to the calculated shearing strains." This patent was found valid and infringed in *Melber vs. Blunk*, in the U. S. Circuit Court, District of Indiana, 1911.

Concrete Buildings.

Ransome Patents.—More than one hundred patents have been granted to Mr. E. L. Ransome of New York for concrete mixers, twisted bar reinforcement, conduit and building details. Under buildings, the two following patents are typical:

Ransome patent 674,576, issued Mar. 4, 1902. The principal claim of this patent reads: "In reinforced concrete construction, a coupling consisting of a lap made by bars and surrounded by an open sleeve large enough to slip over the lap; the whole being fastened together by the concrete in which they are embedded."

Ransome patent 694,580, granted Mar. 4, 1902. There are ten claims to this patent, of which the more important are 6 and 7, as follows:

"A reinforced concrete floor extending to the exterior face of a building and there forming a belt curve, capping the windows and piers below." "A reinforced concrete floor extending to the exterior face of a building with an upward window-sill extension."

This patent has been declared valid and infringed in the case of *Ransome vs. German-American Button Company*, Western District of New York, 1912.

Turner Patents.—Mr. C. A. P. Turner, of Minneapolis, has been granted 12 patents on steel and concrete bridges and on flat-slab floor construction. Their principal development has been in the latter field, covered by the following patents:

Turner patent 985,119, granted Feb. 21, 1911: "A flat-slab and column construction of concrete, including a cantilever head formed of elbow rods having portions thereof embedded in the slab, and other portions thereof extending into the columns a distance less than the height of the columns."

Turner patent 1,003,384, issued Sept. 12, 1911: "In a monolithic concrete structure the combination of a concrete slab having a smooth ceiling or under surface, columns of concrete, reinforcing bars extending vertically through the columns, and horizontally from the upper ends thereof into the slab, and horizontally extending bars in the slab supported by the column reinforcing bar."

Concrete Dams

Ambursen Patents.—The development of the hollow concrete dam has been entirely due to the efforts of Messrs. Church and Ambursen of the Ambursen Hydraulic Construction Company, of Boston, Mass. These two engineers have taken out more than 30 patents covering the various types of hollow dam, as well as on features of construction upon which process patents have been granted; for example, their patented method for taking care of the flow of water during construction by means of narrow piers. Closure is made after completion of the superstructure.

No degrees have been issued by the federal courts under their patents because, for some unknown reason, there has not been a very strong tendency to infringe their patents; perhaps also because the company is known to be strong financially and ready to prosecute any infringer. One or two suits have been entered and are now pending.

Concrete Retaining Walls

Bone Patents.—Mr. Frank A. Bone, of Cincinnati, has been granted two patents on concrete construction, of which the following is an example:

Bone patent 705,732, issued July 29, 1902: "The combination, with a retaining wall having a heel, of a metal structure embedded vertically in said wall and obliquely in said heel, so that the weight of the retained material upon the heel of the metal structure will operate to retain the wall in a vertical position." This patent has been declared valid and infringed in the case of *Bone vs. Hamilton County, Ohio*, in the U. S. District Court for the Southern District of Ohio, 1912.

Concrete Sewers

Mr. W. C. Parmley, of New York, has been granted 6 patents on sewer and conduit construction, among which are the following:

Parmley patent 696,838, issued April 1, 1902: "A concrete arch having embedded therein metal bars which extend continuously through all the regions of tension in extrados or intrados of the arch, and other bars which extend through part only of the regions of tension in either intrados or extrados."

Parmley patent 764,303, issued July 5, 1904: "In an arch structure, rings composed of hardened blocks, said rings being spaced apart, bars in the spaces between the rings, said bars passing through the regions of tension in both the extrados and intrados of the arch and concrete deposited in said spaces so as to embed the bars." In a case against the city of Cleveland these patents were declared valid and infringed.

The patentees that have been enumerated control those patents on concrete construction which have been made commercially successful up to date. There are about 82 patents owned by these gentlemen and each patent has an average of about fifteen claims. They are all alike in that they cover improvements in concrete structures and not in molds, reinforcement, or other devices which are merely auxiliary to the actual concrete construction.

Modernizing A Southern Lime Mill

Paper Presented at Annual Meeting of the American Association of the Advancement of Science, at Atlanta, Ga., Dec. 30, 1913, by Ellis Soper, C. E., Chattanooga, Tenn.

In reviewing the progressional histories of the great industries of man, and without the true prospective, which possibly can be had only when a generation has passed, it would appear to the casual observer that the greatest advancements, growth or improvements have occurred within the last twenty-five years.

Portland Cement has become the building material of the Twentieth Century. 250,000 barrels in 1890 to over 92,000,000 barrels in 1913, represents the growth made **possible** by the rotary kiln and pulverized coal, and **necessary** by the disappearing timber reserves and the demand for a building material at once "flexible," fireproof and cheap. Steel has experienced nearly as great a development. The Aeroplane is here; wireless

tist developed the "wireless." The years of the Chilian Saltpetre beds, the present source of the world's supply of nitrogen, are actually numbered, while our soils must be supplied with plant food to meet the requirements of the ever increasing population, so the scientist with the aid of the electric furnace is recovering the nitrogen from the air and rendering it in another form available for plant food, and to make doubly sure the "By-product" coke oven is producing ammonium sulphate for the same reason.

None of the big industries antedate lime. In some form it was used in building the Nile Temples-Greece and Rome. Its manufacture is possibly the simplest of all. This probably accounts for the erection of



Front View of Main Building, Gager Lime and Mfg. Co., Sherwood, Tenn., Urschel Bates Valve Bag Sacking Machines and S. Howes Co. "Eureka" Packing Machines are used in this plant.

is now an established business; the scientists have harnessed the power in falling water; produced a 4,000° temperature furnace, and reaching into the air is procuring nitrogen for plant food. Supplementing the daily newspaper already is the "Twice-a-Week" periodical enabling one to see the actual events he read about on Monday.

The scientist never yet has failed to respond when called upon by the demands of an ever progressive, aggressive civilization for some new material, machine, process or system created by the ever changing conditions of society and industry.

When man had made **speed** his constant companion, and travel on water became more perilous, the scien-

kilns in the Roman Forum during the "dark ages" and the burning of priceless marbles into lime.

And possibly, because one "unskilled" in the art can build a "bee-hive" kiln, fill it with alternate layers of limestone and wood, and produce a lime which to all intents and purposes meets his needs, to this may be assigned the reason for the unorganized, undeveloped condition that has characterized the lime business from the earliest time to within the last few years, since when there has been a successful effort at concentration, organization and inculcating the "get-together spirit."

Though the process is five thousand years old, there are no standard specifications which the manufacturer must meet. The Association of Lime Manufacturers in

collaboration with other scientific societies has just submitted the first draft of such a set.

The same apparently sudden advance or improvement in the other industries is taking place in the process of lime manufacture. To meet the general

It is the purpose of this paper to describe how one manufacturer is attempting to keep abreast of the modern idea of progression.

The Gager Lime Company of Sherwood, Tennessee, has been operating twenty years; starting with two



Plate 1. View of Quarry, Gager Lime Company. Cyclone Drills, Du Pont Powder, Austin Crushers and Universal Crushers are used by the Gager Company.

demand, as in other lines, for a pure, uniform, easily handled material, the scientist has produced Hydrated lime or mechanically slaked quick-lime. Probably the greatest advantages of Hydrated lime over quick-lime are its ease of handling, with no danger from

kilns, there are now sixteen. Quicklime, Hydrated lime, crushed and pulverized rock, are produced.

The quarry is located about two hundred and seventy-five feet above the plant (Plates 1 and 2) and the kiln rock and crushed rock are delivered to the



Plate 2. General View of Gager Lime Plant, showing quarry and incline above plant. Jeffrey Transmission Machinery used.

fire and substantially no deterioration from storing, and the fact that it is the best waterproofing material for concrete work so far known.

There are approximately one thousand lime plants in the United States. Six years ago there were thirty Hydrate plants, now there are sixty-five.

plant by a "gravity" incline 1400 feet long, the loading car pulling the empty car. The crushing plant is located in the quarry (Austin and Universal crushers used), and all "spalls" made in producing "kiln rock" are crushed. One of the first "well drills" (made by Cyclone Drill Co., Orrville, Ohio) for quarry work was

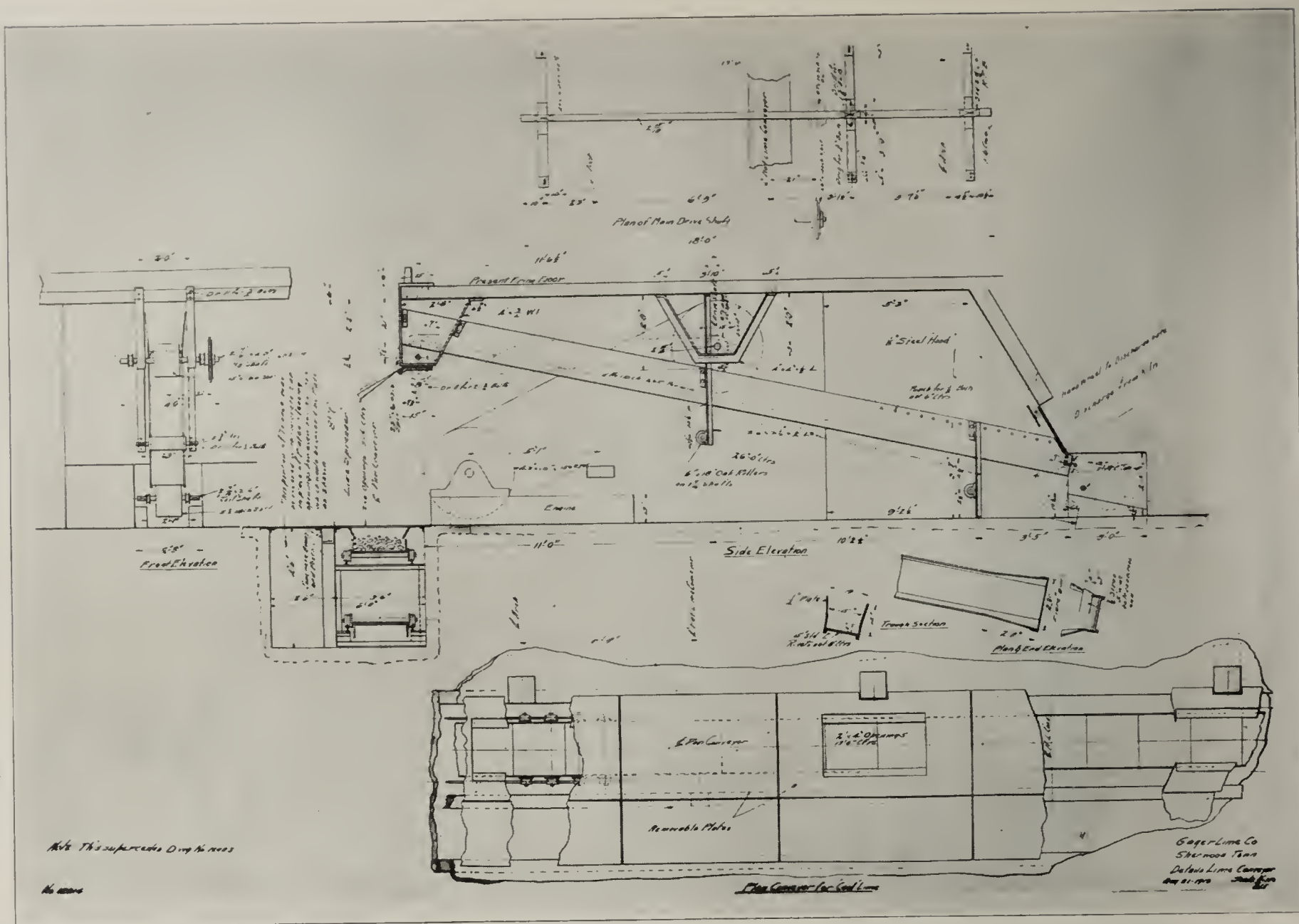


Plate 7. Conveyors for drawing kilns.

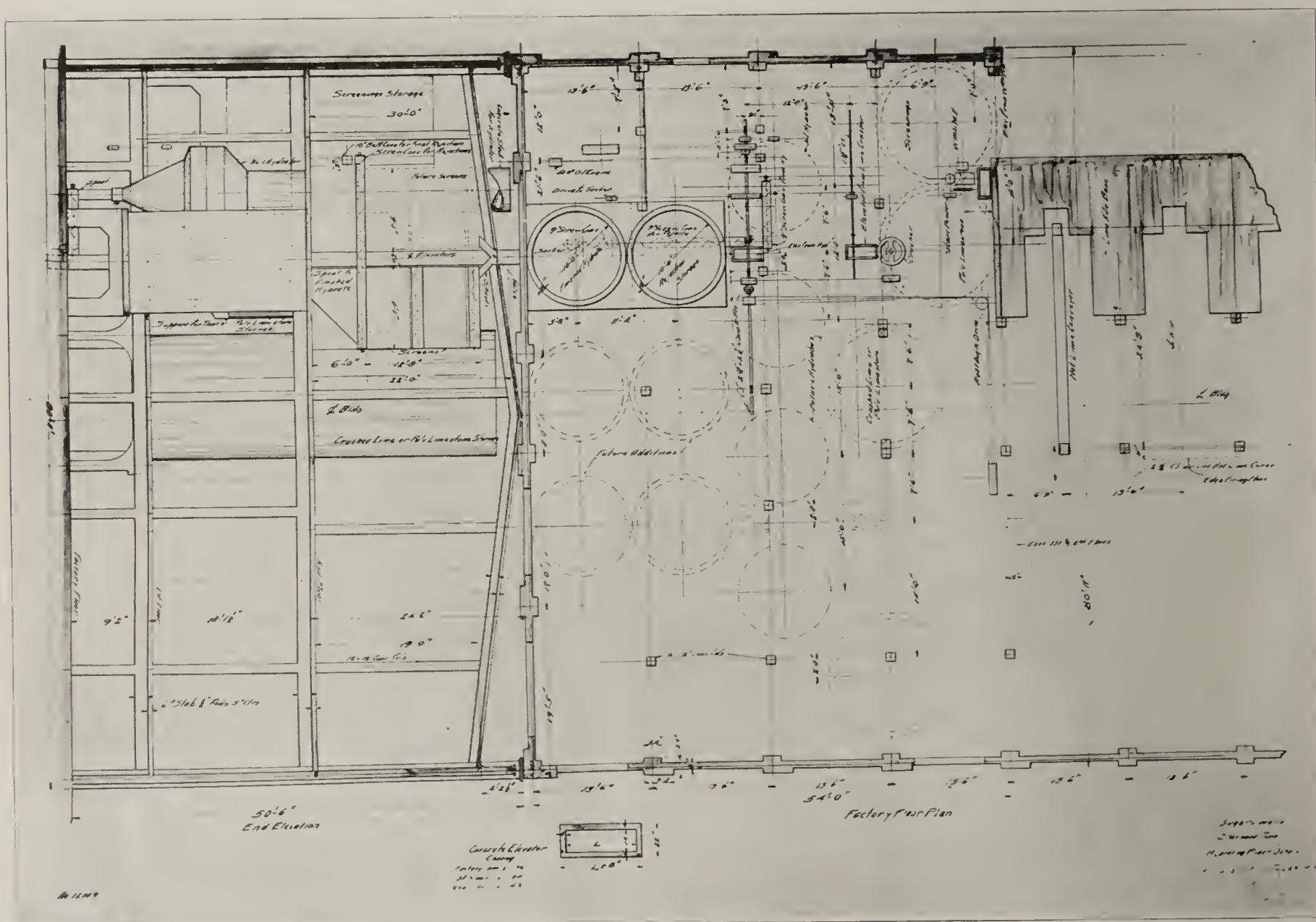


Plate 9. General Drawing of Hydrating Plant, Gager Lime and Mfg. Co.

installed here, and operating on the 100 foot face, has decreased the cost of explosives 250%. DuPont dynamite is used for blasting. The blast holes are bored 110 feet deep.

The step from the small Austin Gyratory Crusher to the steam shovel and the "Mammoth" or No. 21, Austin Crusher, which has a 42-inch receiving opening, has been considered, but labor at \$1.25, coal at \$1.00 and an actual per ton cost of all rock produced of \$0.22½ are pretty strong points for the present at least, in favor of the smaller installations.

Plate 4 shows the foot of the incline and the concrete floor spanning the firing floor and tracks. Plate 5 shows the plan and section of this floor.

Throughout the mill all woodwork has been or is being replaced by concrete. Plate 6 is a typical section of the kilns and "cooling" floor, showing the concrete roofs, walls and rock storage over kilns. Also



Plate 10. Third Floor of Hydrating Plant. Concrete Roof Not Yet Built. Sturtevant Newaygo Screens Are Shown.

the trestle for crushed rock to the cars—Plates 7 and 8 show the "before" and "after" effect on the appearance of the rock storage. Plate 9 is a front view of the Main building and the wooden trestle and bin for crushed rock, which are to be replaced by concrete as shown in the centre.

Originally all the kilns were equipped with so-called "Cooler discharges," these have been replaced by the concrete construction shown in the kiln section on Plate 6. Greater production and increased fuel economy resulted. The average fuel consumption now is four pounds of lime per pound of coal.

Previously the kilns were "drawn" by a man with wheelbarrow. From thirty to forty minutes was required and during this time cold air was being drawn up into the kiln. It was difficult to keep men at this work because of the heat from the hot lime which was wheeled to the cooling floor. Conveyors are being installed, which "draw" a kiln and discharge it into the cooling floor in 1¼ minutes. Two and one half tons of lime are drawn at one time.

Plate 7 represents a section of the "firing" and "cooling" floors and shows this conveyor. A pan-conveyor, is shown in a trench. This delivers the lime into storage bins from which it is barreled or wheeled into cars. The location and the fact that the kilns were already in place precluded the installation of a "gravity bucket" conveyor directly under the kilns.

A Hydrating plant has been installed and provision made for the immediate quadrupling of the present installation. Plate 9 is a general "ground floor" plan and elevation. The process of Hydration is simple. Quicklime is crushed to ¼ inch and under, a certain



Plate 13. First and Second Floors of Hydrating Plant.

amount of water, depending on analysis of the lime, but generally 20% to 30% by weight is added; this is stirred until dry, when it is screened, the finished product being an extremely fine (98% through 200 mesh) fluffy powder; the rejections which represent the impurities in the lime are, in this installation, conveyed to the "screenings" bin, from where they are pulverized and sold for fertilizer. In some plants no separating is done and all the product from the Hydrator is pulverized. It is questionable if this product will compare favorably with one that has been separated. Two processes of Hydration are in use; the Clyde or "batch" and the Kritzer or continuous. The Clyde was installed here.



Plate 14. East End of Main Building.

The storage bins, floors, roof, stairs, columns, elevator casings, posts and drop hangers, screen supports, stack, etc. are all of concrete.

Plates 10 to 11 are typical views showing the concrete bins, elevator casings, screen supports, etc. The large tank to the right in Plate 10 is forty feet above the firing floor upon which it rests. Plate 12 shows the reinforcing under this bin.

The small circular structure to the left in Plate 10 is the "stack" of the Hydrator which carries off the steam during the process of Hydration. This stack will be twenty feet above the roof.

A general view of the first and second floors is shown in Plate 13. The dark cylindrical hopper in the center is the lime measuring hopper attached to a set of scales. This discharges into the Hydrator. The post hangers for the extension of the lime shaft can be seen on the two posts to the right.

Plate 14 is an end view of the main building. The low part to the right will be made the same height as the left, which is not yet completed. Plate 15 shows the south end of the main building.

The concrete mixtures used in this work consist of 1 part cement to which was added 15 per cent of Hydrated Lime, two parts screenings and four parts crushed rock—mixed very wet. Wherever possible, old rails from the quarry were used for reinforcing. The concrete block-tanks or bins, departed considerably from the ordinary method of tank construction. The blocks were made wet in a hand machine. Small recesses were left in the "webs" of the blocks, and when each course was completed steel hoops of the proper size were placed in these recesses. The blocks were laid in rich cement and Hydrated Lime mortar. The cost of these tanks was less than one third the cost of Steel tanks of the same capacity.

The concrete floors were built into these tanks and wherever a floor beam (Plate 13) adjoins the tank, the beam was built into the tank itself. The tanks are waterproof and dustproof.

The elevator casings are of solid concrete blocks, four inches thick. They, too, are built into the floors. The equipment is dustless throughout, and, in our opinion, is completely fireproof, waterproof and age-proof and is still pleasing to the eye.

In modernizing, or bring up "to the minute" a manufacturing plant, it is often difficult to determine just how much to tear out, replace, extend or alter in order that it may conform as closely as is practical to the ideal plant so constructed as to embody the latest, but successfully-proven practice.

Oftentimes the real aim sought which is a direct or indirect reduction of the production cost, is lost sight of, and expenditures are made, the interest on which more than balances the direct saving made by the installation of this labor saving device or that fuel economizer.

The surest, quickest way to sell goods is to demonstrate in a tangible manner our own belief in them. The position of the patent medicine manufacturer who will not permit the use of his product by his family, is no more inconsistent nor incongruous than the Portland Cement manufacturer who builds his foundations and buildings of stone and brick, or the Packard Salesman who drives a Ford.

But in many cases it requires more concrete facts than the scientist is able to marshal into his argument to make the other fellow see his view point.

However, it is the province of the scientist to be the pioneer in all progress. He must look ahead and be able to construct in his vision, the whole system, process or structure which later takes concrete form from the drawings and calculations which must be carefully made based upon precedent, but clear, sound judgment must play the major part.

EXTERIOR PLASTERING SPECIFICATIONS (Recommended by Associated Metal Lath Manufacturers.)

Paragraphs marked "a" apply only to back-plastered walls without sheathing.

Paragraphs marked "b" apply only to walls with sheathing. All other paragraphs apply to both forms of construction.

Materials

1. **Cement.**—The cement shall meet the requirements of the standard specifications for Portland cement of the American Society for Testing Materials. (Standard No. 1, Association of American Portland Cement Manufacturers.)

2. Fine aggregate shall consist of sand, crushed stone, or gravel screenings, graded from fine to coarse, passing when dry a screen having $\frac{1}{8}$ in. diameter holes, shall be preferably of silicious materials, clean, coarse, free from loam, vegetable or other deleterious matter.

3. **Lime.**—The lime shall be thoroughly hydrated either by the manufacturer, or the contractor. If hydrated by the contractor, it shall be slaked in sufficient water to make a soft paste and allowed to stand at least one week before being applied to the wall.

4. **Hair or Fibre.**—There shall be used only first quality long hair, free from foreign matter, or a long fibre well combed out.

5. **Coloring Matter.**—Only inorganic colors shall be used, which are not affected by lime, Portland cement, other ingredients or the weather.

6. Water shall be clean, free from oil, acid, strong alkalies or vegetable matter.

Preparation of Mortar

7. **Mixing.**—The ingredients of the mortar shall be thoroughly mixed to a uniform color, sufficient water added to obtain the desired consistency, and the mixing shall continue until the cement and lime are uniformly distributed and the mass is uniform in color and homogeneous.

The hair or fibre shall be added during the process of wet mixing.

8. **Measuring Proportions.**—Methods of measurement of the proportions of the various ingredients, including the water, shall be used which will secure separate uniform measurements at all times. All proportions stated are by volume. A bag of cement shall be assumed to contain 1 cu. ft. Lime when used shall be measured in the form of putty. Hydrated lime shall be made into putty before being measured. A cubic foot of lime putty contains .31 cu. ft. of hydrated lime weighing 45 lbs. and .69 cubic feet of water weighs 43 lbs.

9. **Quantity.**—There shall not be mixed at one time more mortar than will be used within one hour. Mortar which has begun to stiffen or take on its initial set shall not be used.

10. **Hand Mixing.**—The mixing shall be done on a water-tight platform and the materials shall be turned until they are homogeneous in appearance and color.

11. **Consistency.**—The materials shall be mixed so as to provide sufficient water to insure a proper bonding and a dense mortar free from voids.

12. **Retempering.**—Retempering mortar, i. e., re-mixing with water after it has partially set, shall not be allowed.

Structure.

13. **Framing.**—Studs spaced at 12 in. centers wherever possible shall be run from foundation to rafters without any intervening horizontal grain in the wood. These studs shall be tied together just below the floor joists by 6 in. boards which will be let into the studs on their inner side, so as to be flush and securely nailed to them. These boards will also act as sills for the floor joists, which in addition will be securely spiked to the side of the studs.

14. **Bracing.**—The frame of the building shall be so rigidly constructed and braced as to avoid cracking the stucco (a) at least one point between each two floors, brace between the studding with 2x3 in. bridging.

(b) Bracing may be omitted, as the sheathing boards act as bracing.

15. **Sheathing.**—(a) The lath is to be fastened direct to the studding and back-plastered and no sheathing boards are to be used.

(b) Sheathing boards shall be not less than 6 in. or more than 8 in. wide, dressed on one or both sides to a uniform thickness of $\frac{7}{8}$ in. They shall be laid diagonally across the wall studs and fastened with two nails at each stud.

16. **Inside Waterproofing.**—(a) The faces of the stud and for one inch back of the face on each side where the plaster may come in contact with them, shall be thoroughly waterproofed with tar or asphalt.

(b) Over the sheathing boards shall be laid in horizontal layers, beginning at the bottom, a substantial paper well impregnated and thoroughly waterproofed with tar or asphalt. The bottom strip shall lap over the base board at the bottom of the wall, and each strip shall lap the one below at least 2 in. The paper shall lap the flashings at all openings. When required, the lower horizontal edge of each strip shall be cemented with hot or liquid tar or asphalt compound, to the strip below and to the grounds of flashings at all openings. All tacking shall be within 2 in. of the top horizontal edge, where tacks will be covered by the lap of the strip above.

17. **Furring.**—When furring forms a part of the metal lath to be used, then separate furring as described in this paragraph is to be omitted.

(a) Galvanized or painted $\frac{1}{2}$ in. crimped furring not lighter than 22 gauge or other shape giving equal results shall be fastened direct to the studding, using $1\frac{1}{4}$ in. x 14 gauge staples, placed 12 in. apart.

(b) Galvanized or painted $\frac{1}{2}$ in. crimped furring not lighter than 22 gauge or other shape giving equal results shall be fastened over the sheathing paper and directly along the line of the studs, using $1\frac{1}{4}$ in. x 14 gauge galvanized staples, placed 12 in. apart. The same depth of furring should be adhered to around curved surfaces and furring strips shall be placed not less than $1\frac{1}{2}$ in. or more than 4 in. on each side of and above and below all openings.

18. **Preparation of Original Surface.**—All roof gutters shall be fixed and down-spout hangers and all other fixed supports and fasteners shall be put up before the plastering is done, so there will be no break made in the plastering where they are permanently fixed.

Wall copings, balustrade rails, chimney caps, cornices, etc., shall be built of concrete, stone, tile or metal with ample overhang drip grooves or lip, and watertight joints, to keep water from behind the plaster.

If wood sills are used, they should project well from the face of the plaster and have ample drip groove or lip.

Metal lath shall be stopped far enough above the level of the ground to be free from ground moisture.

Care should be taken to provide for placing all trim the proper distance from the studding or furring to show its right projection after the plaster is on.

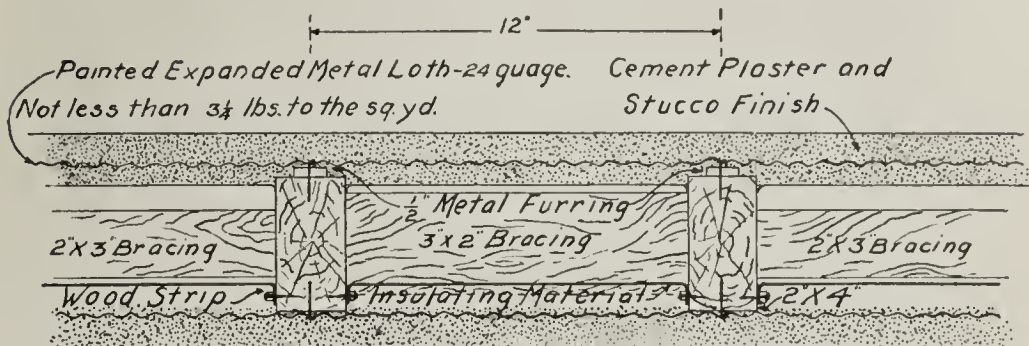
19. **Lath.**—The lath shall be not thinner than 24 gauge, galvanized or painted, expanded metal lath weighing not less than $3\frac{1}{4}$ lbs. to the square yard.

20. **Application of Lath.**—Place lath horizontally over the furring driving $1\frac{1}{4}$ in. x 14 gauge galvanized staples 8 in. apart over the furring into the studding. The sheets of lath shall be locked or lapped at least

1 in. and tied at joints between studs both vertically and horizontally with 18 gauge wire.

21. **Corners.**—There shall be 6 in. strips of metal lath bent around the corners and stapled over the lath, or the sheets of metal lath shall be folded around the corners a distance of at least 3 in. and stapled down, as applied. Galvanized corner bead may be applied over the lath.

22. **Insulation.**—(a) After the lath on the outside has been back-plastered, the air space may be divided by applying heavy building paper, quilting, felt or other suitable insulating material between the studs, fastening it to the studs by nailing wood strips over folded ends of the material. This insulation should be

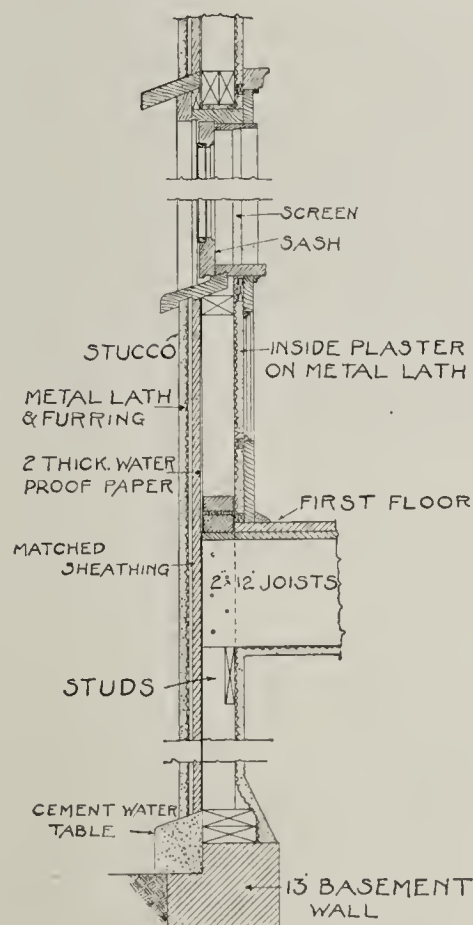


Detail Showing Section of Exterior Wall

Fig. 1. "A" Type.

so fastened as to clear the bridging, leaving the preponderance of the air space next to the plaster. Care must be taken to keep the insulating material clear of the outside plaster and to make tight joints against the wood framing at the top and bottom of the spaces and against the bridging where the face intercepts.

(b) When quilting, felt, or other insulating material is to be used it shall be applied to the sheathing boards under the inside waterproofing.



WALL SECTION

'B' TYPE STUCCO WALL

Fig. 2.

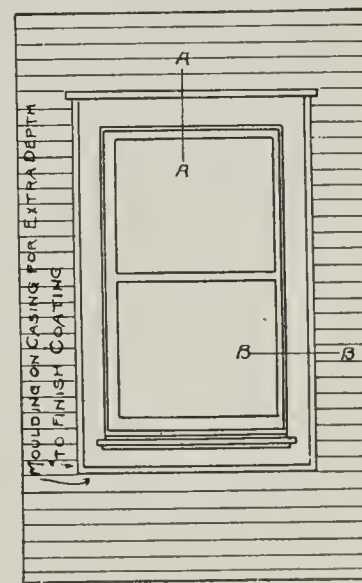


Fig. 4.

Mortar Coats.

23. **Plaster.**—(a) The first coat shall contain not more than two and one-half ($2\frac{1}{2}$) parts of sand to one (1) part of Portland cement by volume. If lime putty is added, it shall not be in excess of one-third ($\frac{1}{3}$) of

the volume of cement. Hair or fibre may be added in sufficient quantity to bond the mortar.

(b) The first coat shall contain not more than two and one-half ($2\frac{1}{2}$) parts of sand to one (1) part of Portland cement by volume. If lime putty is added it shall not be in excess of one-third ($\frac{1}{3}$) of the volume of cement. No hair, fibre or similar material of any kind or in any quantity shall be added to the mortar.

For second coat, the proportion of sand to cement shall not be greater than $2\frac{1}{2}$ to 1 by volume, nor shall more than $\frac{1}{3}$ part of lime putty be added.

For third coat, the proportion of sand to cement shall not be less than 2 to 1 nor more than $2\frac{1}{2}$ to 1, by volume, nor shall more than $\frac{1}{3}$ part of lime putty be added.

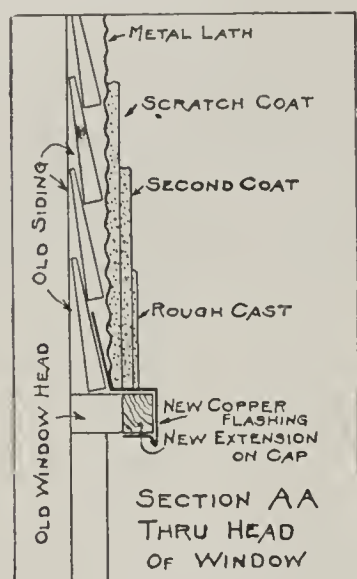


Fig. 5.

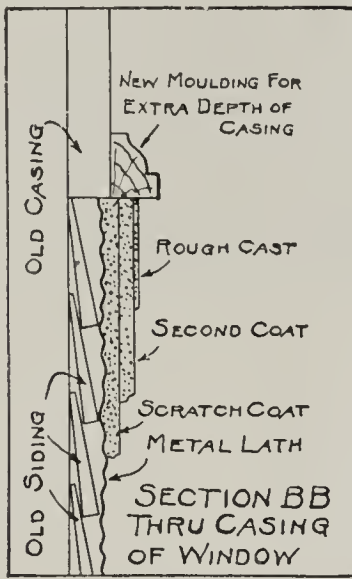


Fig. 6.

24. **Waterproofing.**—When a special waterproofing is to be added to mortar for stucco work, it shall be added in strict accordance with the specifications of the manufacturer. Lime should be omitted in the coat in which waterproofing may be used.

25. **Application.**—The plastering should be carried on continuously in one general direction, without allowing the plaster to dry at the edge. If it is impossible to work the full width of the wall at one time, the joint should be at some natural division of the surface, such as a window or door.

(a) The first coat shall be applied to the outside of the lath and pushed through sufficiently to give a good key. Over the face of the studs the plaster shall be forced well through the lath in order to fill entirely the space between the lath and the stud. The backing coat shall be applied to the back of the lath and shall be thoroughly troweled so that the lath shall be entirely covered. The final coat shall be applied to the face of the first coat.

(b) The first coat shall be applied to the lath and thoroughly pushed through against the inside waterproofing so as to completely imbed the metal of the lath on both sides. Special care shall be taken to fill all voids around furring strips and where lath laps.

26. **Roughing.**—Soon after applying and before the initial set has taken place, the surface of the coats which are to receive succeeding coats shall be roughened with a saw-toothed paddle or other suitable device.

27. **Dampening.**—Before applying mortar the surface of the preceding coat shall be thoroughly wetted to prevent absorption of water from the fresh mortar.

28. **Thickness of Coat.**—(a) The first coat shall be at least $\frac{3}{8}$ in. thick over the face of the lath and project through behind the lath about $\frac{3}{8}$ in. The backing coat shall increase the thickness behind the

lath to not less than $\frac{5}{8}$ in. The final coat shall be not less than $\frac{3}{8}$ in. thick.

(b) The first coat shall have a minimum thickness over the lath at any point of not less than $\frac{1}{4}$ in. The intermediate coat shall have a thickness of not less than $\frac{1}{4}$ in. or more than $\frac{3}{8}$ in. The final coat shall have a thickness of $\frac{1}{4}$ in. when placed over an intermediate coat, or of $\frac{3}{8}$ in. when placed directly on the scratch coat.

29. **Drying Out.**—The final coat shall not be permitted to dry out rapidly and adequate precaution shall be taken, either by sprinkling frequently after the mortar has set hard enough to permit it or by hanging wet burlap or other material over the surface.

30. **Freezing.**—Stucco should never be applied when the temperature is below freezing.

Finish.

31. **Smooth Troweled.**—The finishing coat shall be troweled smooth with a metal trowel with as little rubbing as possible.

32. **Stippled.**—The finishing coat shall be troweled smooth with a metal trowel with as little rubbing as possible, and then shall be lightly patted with a brush of broom straw to give an even stippled surface.

33. **Sand Floated.**—The finishing coat, after being brought to a smooth, even surface, shall be rubbed with a circular motion of a wood float with the addition of a little sand to slightly roughen the surface. This floating shall be done when the mortar has partially set.

34. **Sand Sprayed.**—After the finishing coat has been brought to an even surface, it shall be sprayed by means of a wide, long fibre brush—a whisk-broom does very well—dipped into a creamy mixture of equal parts of cement and sand, mixed fresh every 30 minutes and kept well stirred in the bucket by means of the whisk-broom or a paddle. This coating shall be thrown forcibly against the surface to be finished. This treatment shall be applied while the finishing coat is still moist and before it has attained its final set, i. e., within 3 to 5 hours. To obtain lighter shades add hydrated lime of 5 to 15 per cent of the volume of the cement.

35. **Splatter Dash or Rough Cast.**—After the finishing coat has been brought to a smooth, even surface and before attaining final set, it shall be uniformly coated with a mixture of one part cement and two parts of sand thrown forcibly against it to produce a rough surface of uniform texture when viewed from a distance of 20 feet. Special care shall be taken to prevent the rapid drying out of this finish.

36. **Pebble Dash.**—After the finishing coat has been brought to a smooth, even surface, and before attaining initial set, clean round pebbles or other material as selected, not smaller than $\frac{1}{4}$ in. or larger than $\frac{3}{4}$ in., previously wetted, shall be thrown forcibly against the mortar so as to embed themselves in the fresh mortar. They shall be distributed uniformly over the surface of the final coat and may be pushed back into the mortar with a clean wood trowel, but no rubbing of the surface shall be done after the pebbles are embedded.

37. **Exposed Aggregates.**—The finishing coat shall be composed of an approved, selected coarse sand, marble dust, granite dust or other special material, in the proportion given for finishing coats and within 24 hours after being applied and troweled to an even surface, shall be scrubbed with a stiff brush and water. In case the cement is too hard a solution of one part hydrochloric acid in four parts of water by volume can be used in place of water. After the aggregate particles have been uniformly exposed by scrubbing,

care shall be taken to remove all traces of the acid by spraying with a hose.

38. Mortar Colors.—When it is required that any of the above finishes shall be made with colored mortar, not more than 6 per cent of the weight of Portland cement shall be added to the mortar in the form of finely ground coloring matter.

A predetermined weight of color shall be added dry to each batch of dry fine aggregate before the cement is added. The color and fine aggregate shall be mixed together and then the cement mixed in. The whole shall then be thoroughly mixed dry by shoveling from one pile to another through a $\frac{1}{4}$ in. mesh wire screen until the entire batch is of uniform color. Lime putty, if used, and water shall then be added to bring the mortar to a proper plastering consistency.

Machine Stucco.

39. Stucco may be applied by a machine provided the results obtained are equal to those produced by hand work.

Overcoating.

40. During recent years there has come into vogue a method of remodeling old frame houses. This "overcoating," as it is called, is used extensively in all sections of the country and the following practice is recommended.

Preparation of Original Surface.—Every house has its own defects and characteristics and each must be treated according to its physical condition.

A tight roof is essential.

Where furring is used so deep that the space back of the lath is not entirely filled with plaster, some provision must be made for extending the old window and door frames to correspond with the increased thickness of the wall. In some cases the plaster is brought over the old frames in such a manner that a recessed window or door opening is made. In case the furrings are fastened to the studding, it is not necessary to provide for extending the window and door frames, as the new stucco finish will have the same relations as the old weather-boarding.

If the weather-boarding is in poor condition it should be removed and furring and metal lath applied over the sheathing, to which waterproof paper has previously been fastened. It may be advisable also to tear off the sheathing, in which case the furring can be fastened direct to the studding after bracing between the studs and then finish as type "A" above.

Another method would be to fasten the furring to the weather-boards to which the metal lath is applied, after applying waterproof paper over the weather-boarding.

In preparation for any of these methods the house should be gone over carefully to determine if the frame work is well enough preserved to justify the improvement.

The doors should be looked after, the studding inspected, partitions and outside walls lined up and brought into plumb.

41. Furring.—Fasten galvanized $\frac{1}{2}$ in. crimped furring or other shape giving equal results, vertically over the original surface, whichever of the above may be adopted.

42. Lathing and Plastering.—Follow the above specifications for stucco.

LECTURE ON GRAVEL ROADS

Mr. Paul D. Sargent, M. Am. Soc. C. E., Chief Engineer, State Highway Commission, Augusta, Me., on January 20th delivered an illustrated lecture on "Gravel and Its Use in Highway Construction" before the Graduate Students in Highway Engineering at Columbia University.

SAND WASHING PLANT

"The wheat and the tares" problem in the sand industry is being solved in Kansas City, and its solution is being put into actual demonstration at the plant of the Kansas City Sand Company, the new plant situated on the Kaw River.

The big feature of the new plant is a new invention to wash the sand as it is taken from the bottom of the river. The days when new sand was half mud, a quarter shale and the rest coarse sand are past, and now by the use of the new device on the Kaw, two grades of clean sand are available, loaded and certified.

The device is the invention of W. H. Caffery, president of the Western Crushed Rock Company, and Charles Meierhoffer, president of the Missouri River Sand and Gravel Company. It was put into actual operation last Tuesday. It was erected at a cost of \$50,000 says the Kansas City Star.

The plan of the sand laundry is simple. A barge in the river carries a pump propelled by a 300-horsepower electric motor. A suction pipe from the barge to the river bottom carries the sand, mud, gravel, water and all up through the barge, through a 10-inch pipe, into a big steel pan, forty feet wide, at an elevation of about fifty feet, forced there by the pump in the barge. There the sand being the heaviest ingredient in the whole mess, sinks to the bottom of the big pan, while the mud and the refuse is washed on with the water flowing from the pipe.

The constant flow of water from the river through



Concrete Bridge of Attractive Design Built by the Curwensville Construction Co., at Tyrone, Blair Co., Pa. A. M. Bloom, Engineer in Charge; H. G. Hinkle, County Engineer.

the big pipe washes the cleansed sand through a sieve running the full forty feet of the pan into a basin. The force of the water carries the fine sand over the basin into a second, while the coarser grades fall into the first bin. The fine sand then follows the water up over a partition into a second bin, thus giving two grades of perfectly clean, pure sand. The mud and refuse then is carried lightly from the laundry back into the river through the outlet pipe.

The bins are built over railroad tracks at an elevation sufficient to allow a sand car to run under. The simple manipulation of a lever lets the sand fall from the bin into the car, loading it in a very short time.

The capacity of the plant is seventy-five cars a day, or about three thousand tons. Two men in the barge to operate the pump and to direct the suction pipe and two men at the bins are all that are necessary to operate the whole concern, except, of course, the train crew, for the loaded cars.

THE LA SALLE-OGLESBY CONCRETE HIGHWAY

The "La Salle-Oglesby Concrete Highway" is successor to the old "Bottom Road"—a wonderful trans-

the upkeep averaging over seven hundred dollars annually during the past ten years. The new road is better suited to all forms of traffic, gives better service, and its upkeep is practically negligible.



The La Salle-Oglesby Concrete Highway.

formation from dust, mud and ruts, to a permanent, smooth, clean highway. The old road, because of the immense amount of traffic which it carried daily, was always in bad condition. Its surface was not rigid enough to withstand the jar of heavily laden wagons, and occasional floods washed and rutted its surface. Its maintenance was a heavy burden on the township,

The assistance rendered possible from the State and County under the movement for improved roads brought about an attempt to provide a permanent highway to take the place of the burdensome makeshift of the past. Once the plan was initiated the spirit of co-operation which manifested itself made the problem easy of solution.

The Marquette Cement Manufacturing Company and the Chicago Portland Cement Company offered to supply, free of cost, sufficient cement for a twenty-foot highway, and to defray the freight and drayage charges on the sand and gravel, which were donated by a number of sand and gravel companies affiliated with the National Sand and Gravel Producers' Associations. The latter contributions were secured at the instance of Mr. Frank Fenwick, President of the Joliet Sand and Gravel Company, and Mr. P. M. Lewis, Secretary and Treasurer of the American Sand and Gravel Company. These donations, when offered to the Board of Township Highway Commissioners, were promptly accepted, the commission agreeing to defray the necessary labor cost. The highway was constructed under the direction and supervision of the Illinois State Highway Department.

When the work of construction was well advanced Hon. F. W. Matthiessen, actuated by his usual high regard for public safety, presented to the Township a concrete rail fence, at once substantial and artistic, designed by Mr. Richard Moyle, Superintendent of the Marquette Cement Manufacturing plant. The Citizens Lighting Company then generously offered the use of its concrete transmission line poles for the installation of a lighting system, and agreed to furnish free of charge the lamps and globes and current for illuminating purposes for one year. The illumination of the highway is only a forerunner of a new era of night travel in the country.

As shown by the illustration, La Salle Township to-day boasts of a highway second to none in the United States. The passage of constructive road legislation during the 1913 session of the Illinois Legislature providing State aid for every county in Illinois makes it possible for the example set by La Salle Township to be followed throughout the State. Every community is not blessed with such a generous contingent of progressive concerns and individuals, who, working together, have lent so much loyal assistance to the completion of the highway project; but it is to be hoped that the rapidly growing sentiment for good roads will soon crystallize into action in other localities.

FIRE TEST ON REINFORCED CONCRETE

A Fire Test on a Reinforced Concrete Tank was conducted recently by Howarth Erskine, Ltd., before a body of engineers and architects in Singapore, India. The tank was of cubical shape, 5 ft. edge measurement, with walls 3 in. thick plastered on No. 24 gauge Hy-Rib, extending horizontally. The corners were reinforced with 2 $\frac{3}{4}$ -in. angles. The mortar used consisted of five parts of cement, twelve parts of sand and one part of lime paste, and Truss-Con waterproofing paste, manufactured by the Truss-Con Laboratories, Detroit, Mich., was used in the water. The tank was tested when 29 days old, and for two weeks previous it was kept filled with water, no leakage resulting. After emptying the tank, 160 gal. of kerosene, equivalent to about 12 in. depth were poured in and ignited. The fire burned for 2 $\frac{3}{4}$ hours and measurements taken at intervals showed a maximum deflection of $\frac{3}{8}$ in. at the center point of the side. The tank while still warm was filled with water to a level of 18 in. below the top. According to the official report of the test, water leaked out of some few cracks that had formed, but the walls maintained their strength and elasticity against the water pressure.

THE "UNIVERSAL" EXHIBIT

The exhibit of the Universal Portland Cement Co., at the Seventh Chicago Cement Show consisted of a series of booths, in which the company had a definite purpose in view towards the education and illustration of the value of cement and its various uses.

The reception booth, with its beautiful arch, was used for a double purpose: First, to give an opportunity for customers and friends of the company to meet the members of its organization; and, secondly, to show the really remarkable results which are possible in concrete for factory, warehouse or other building construction. The striking beauty of this structure lies in the close harmony between the general lines and the medium, bush-hammered concrete. The surface treatment—bush-hammering to expose a light-colored coarse aggregate—demonstrates the workmanship and the spirit of the original.

Another booth illustrated concrete surfaces to show them incorporated in actual building details, rather than in small panels which do not adequately show their effect in large areas.

The problem of fire losses of buildings was taken care of in a separate booth. One of the best examples of a recent design of fire escapes is shown by a model made from the new building of the Kahn Tailoring Co. The escape takes one-half panel of the building, has reinforced concrete stairs and landings, has glass on three sides so that no light is lost in the interior and represents maximum safety with no sacrifice of light and appearance. A number of drawings illustrating fire protection in mines, etc., was also exhibited.

In the promotion of the "Bulk Cement Campaign" the company exhibited models of two simple devices which will undoubtedly be of value along these lines. The first of these was a device by means of which bulk cement (or other materials) may be accurately measured by weight. The other model showed a simple installation of bins, which may be built at low cost in any concrete products factory, or even on a construction job of reasonable size.

The sack exhibit was a morgue. Placed in separate coffins were the various dying stages of a cement sack, due to rough usage, etc., and standing as a mute appeal to be more careful with the empty sack. Each of the dead sacks lay in its little coffin, and over each there was a tombstone telling by what violent means it met its death. These tombstones will repay careful study, because it may be that some of your sacks are being slaughtered in the same way as were the unfortunate victims that have been gathered together in this exhibit.

Farmers were interested in the booth illustrating the concrete barn shown in No. 112. This structure illustrated the absence of fire and lightning danger, the absence of insurance premiums and the impossibility of being entirely wiped out of existence in a few hours.

In booth 111 the aim was to demonstrate that anybody can make watertight concrete, provided sufficient care is used in the mixing and proportioning of materials.

In booth 110, samples were seen of pit-run gravel before and after screening, with blocks of concrete made with cement and bank run material, as well as a mixture of the cement, with the separated material properly mixed and proportioned. The aim of this booth was to assist in the better selection of aggregates.

The subject of concrete roads was handled in booths 123 and 124, with charts indicating standard practice for county highways and for city streets. Both one

and two-course pavement sections were shown, suitably protected with approved joints. Two approved steel protecting plates for expansion joints were shown, together with their installing devices.

Hydro-stone is a concrete building unit which offers a very wide range of surfaces to the designer and builder. Fire walls of Hydro-stone were built between the several booths of this company, which were illustrative of the broad application of well-made concrete blocks to the better class of buildings.

The educational value of the exhibits of the Universal Company was important to every visitor and exhibitor and well worth a careful study.

INTERSTATE CEMENT TILE CONVENTION

The Interstate Cement Tile Manufacturers' Association opened the first session of its annual convention at 2 p. m. Tuesday, Feb. 17, in the Auditorium Hotel, Chicago. When President P. H. Atwood called the meeting to order the room was comfortably filled with live members of the organization.

J. J. Commons, of the Chicago Portland Cement Co., Chicago, Ill., delivered the address of welcome, which was responded to by J. J. Hammen, of Sac City, Iowa, on behalf of the association.

President Atwood's Address

President P. H. Atwood, after greeting the members, said that a convention to be successful must have three parts: one part to introduce the subject by presenting it in a general way, bringing out the main points. Another part, being ready to ask questions on the different phases of it, and the third part, ready to give their experiences along the various lines. He went on to say that if we all do our part it will make this convention the best ever held, as regards benefits to the members. Continuing, Mr. Atwood said:

"In comparing the tile business of today with five years ago it was found that not one-half as many plants are in business now as there were then. The tile business has gotten by the \$5,000 and \$10,000 plants and has advanced to \$25,000 and \$75,000, and another five years will likely see double the amount of capital required for the more successful plants."

President Atwood touched upon the question of buying the best machinery for the manufacture of concrete tile. He stated that the Iowa Drainage Association has adopted tentative specifications for strength and absorption of drain tile, and intimated that business in the future will be secured by the plants that follow such specifications. There is a great outlet for cement pipe, he said, in the future, by the closing of the open ditches; larger tile being used right along for this class of work in Iowa, Minnesota and Illinois.

* * *

R. P. Van Deusen, civil engineer of Pekin, Ill., was slated for an address on "Cement Tile as a Drainage Engineer Sees It," but in the absence of Mr. Van Deusen, James McCutcheon, of Hennepin, Ill., was called upon by the chairman to make some remarks, and he spoke as follows:

"We turned out 3,000 to 3,500 tile a day; in November we shipped about 70,000, but our trouble is lack of barges, in addition to being weak in railroad facilities. The deep waterways proposition will help us. The hardest knocks we get come from the clay people, who go out and get our prices and cut in on our business. If the cement tile people would get together and get uniform prices like the clay people do I believe it would be of benefit." A. D. Miller, of Goshen, Ind., then read a paper on "The Business End of Tile

Manufacturing." Mr. Miller said in part: "In regard to the business end of tile manufacturing I would say that the first important part is to arrange the factory so as to use as few men as possible in handling the material, and my way of doing this is to have a pit on the outside of the factory wherein to dump the sand, and from there by elevating with a belt conveyor inside the building to a bucket conveyor which will carry the sand into the screen and then carried by a screw conveyor into a small bin so arranged as to measure the sand according to the amount that must be used.

"The second important feature is the use of a batch mixer located under the measuring device, and by using a batch mixer the material is always in front, so that the mixer man may know when the cement and sand are thoroughly mixed dry before adding water. There are occasions once in a while when the sand is too dry, then it is very important that water be added before applying the cement. By this method, with good sharp sand, there will always be a very good mixed material; by using three parts sand and one part cement this will make the very best tile with the proper curing device.

"I would recommend either a single or a double track kiln. We use the double track, which affords the very best results. These kilns should be air-tight and should be so arranged as to be furnished with all the condensed steam that the tile could absorb for at least 30 hours. I would recommend furnishing this condensed steam from the exhaust steam of the engine where the plant is run by steam power, but in using electric power I would suggest the installation of a boiler so that the top of same is lower than the curing room, in order to have plenty of gravity to put in a return hot water system.

"We have in our plant in the center of the whole length of our lines a trough eight inches square filled with water, with a pipe running through the trough from one end to the other in which the water is moving continuously back to the boiler and return. This causes the water to boil in the trough and will condense the water into vapor steam.

"I would also suggest that after the tile is piled on the yard that pipes be so arranged that the tile could be sprinkled once a day. The proper time in the summer months would be in the evening.

"Now I find in making my visits to different plants, that with the way we have our plant arranged, we can manufacture tile with one man less than any of our competitors, where they handle all their material by using a shovel, shoveling the sand into the mixer and then also shoveling their mixed material into a place from which it is carried into the tile machine. The way we have our plant arranged, from the time the sand drops from the wagon we need not touch it until it is made into tile; which we claim is very necessary in order to lower the cost of manufacturing tile."

In reply to a question from President Atwood as to his method of selling the product, Mr. Miller said: "We advertise in the local papers, with a view to educating the people as to the use of cement tile. We have people come 12 miles to haul our tile, where they could buy clay tile nearer home. We had the Universal people send us some of their booklets, which we distributed to the farmers in our vicinity. We make tile up to 16 inches. We generally have an advertisement in the newspaper for three months at a time, and carry a cut of our factory and change the advertisement occasionally. Where cement tile are laid in shallow places frost will have no effect on them, whereas clay tile is affected by frost. We absolutely guarantee our product."

President Atwood: Have you anything in regard to cost data?

Mr. Miller: We know what it costs us to manufacture 4, 5 and 6-inch tile. We make a record every day, and know how much sand and cement we use and figure up every evening. Sand is costing us 70 cents a yard, unscreened. We use $\frac{1}{2}$ -inch mesh screen for all sizes of tile.

Mr. Hammen: Summing up the amount of sand, labor, material, etc., used during a day, we keep track of each size of tile made and figure on tonnage basis and check up every night.

Messrs. Speis, Hammen, Dennison, Sokall, Rice and other members discussed the subject of cost at some length, and the question of what constituted overhead expense was also gone into very carefully.

Mr. Bingham outlined the process of curing tile, and stated that he believed that the best method of manufacturing it was to put the necessary water in the tile when they are made and add no further moisture. Other members spoke of sprinkling the tile after it had been made.

The paper prepared by Arthur S. Bent, of Los Angeles, Cal., on "Construction of Concrete Pipe Lines," was read by Mr. Jones, in the absence of the author.

Mr. Bent reviewed briefly the history and development of concrete pipe and the part it has played in the upbuilding of the empire of the West. The pre-eminence of concrete pipe as a water pipe is based upon the remarkable fitness for the service required, which is not even approached by any other material, and to this must be added its low cost, which is again an unusual condition, for, though the best is the cheapest in the end, it is seldom the least costly at the beginning.

The paper went on to point out that Portland cement has become the leading factor in irrigation projects throughout the barren deserts of the West and the orchards and fields of southern California, where irrigation has now reached the highest development in the world. All this led to the concrete pipe irrigating system. Thirty years ago the first crude attempts were made in southern California to manufacture and lay concrete pipe lines for irrigation purposes.

In closing Mr. Bent's paper stated: "Concrete pipe is the very warp of the fabric of arid land development, and its use has extended to every civilized region where water is conveyed to soil. So ideally does it perform this service that we may claim it will ultimately carry all the irrigation water of the world, and that where concrete pipe is most used will be found the most competent civilization and the arena for the highest achievement of the human race."

President Atwood: I am against this freezing proposition. I have noticed that the tile which freezes does not have the strength of the tile which does not freeze. We never send any of our tile out that has once frozen. In regard to getting boards and supervisors to accept cement tile, it seems to me it is getting to be one of the easiest things to do today. In the past there has been a great deal of poor cement tile put on the market. We have overcome that to a great extent in Iowa at the present time through the adoption of standard specifications. Any cement man can compete with the clay product and have those specifications used, and just as soon as you can get those specifications adopted by your supervisors you have got some basis on which to make your competitor work. The strength of tile in a drain depends on the width of the ditch. You can put a foot wide

tile in a ditch, and that will just hold it. It just depends upon where the tile is placed how strong the tile has got to be to hold up the load.

President Atwood appointed the following nominating committee: Fred Spies, Graetting, Iowa; A. D. Miller, Goshen, Ind.; James McCutcheon, Hennepin, Ill.

The meeting then adjourned to reconvene at 10 o'clock Wednesday morning.

WILL CEMENT DRAIN TILE, STAND

In your January issue on page 3 I note an article by Wm. Passage of Baily, Michigan, in regard to cement tile. I am very sorry to see any man having trouble with cement tile, but we are taught that just as sure as you violate the laws of nature you must pay the bill and it is just the same with concrete. First what does it require to make good concrete? This would be my definition: Good quality of material; enough cement to practically fill the voids, or say a one to three-to-one to $3\frac{1}{2}$ mix; thorough mixing and in light wall work such as we have in drain tile, enough water so that when tile are thoroughly packed, (so you can hardly dent them with your finger before the jacket is removed), a web-like marking will be on the tile when jacket is removed. This has been our object for six years and in that time we have kept our plant running at least two hundred seventy-five days in the year; and we have yet to find the first tile that has disintegrated in that time.

Now let us look at Mr. Passage's tile. First—they were a mix of one to five (a leaner mix than is allowed by any reputed factory). Second—they are a sieve, as a 3" tile will absorb water faster than 2-6" clay. There is only one way to make this kind of tile lean in cement, very dry and not half packed. Three things that practically anyone of them would make a poor article, but with the combination of the three, which Mr. Passage has, it is no wonder to me that all he has is a streak of sand.

Why do I know he has the combination of the three? Well first he gives the mix—1 to 5—that is settled. Second—He has made the tile with a hand tile machine, when it requires fifteen to twenty horse power with us, and last the tile had to be kept in a casing to hold them up when the jacket was removed.

I have often wondered if all the "Cheap John" tile machines gotten out to get the farmers' money weren't fathered by the clay publicity bureau, as it has always been their object to joint to just such failures as these; but which can be jointed to in the clay as well as the cement; as we replaced one job at Halfa, Iowa, of this kind where the bottoms of two-thirds of the clay tile were entirely gone. Now this was not the fault of the clay tile, but simply the fault of the incompetent manufacturer where nine-tenths of all failure, either in clay or cement lies. There is as much area of space in 20 spaced between drain tile as there is area in the tile, why do you want a sieve? Make a tile just as wet and dense as possible. The joints will take care of the rest.

If you are interested in what a drain tile is required to hold up—be it clay or cement, and other things required in order to have a good article, write the Iowa Experiment Station, Engineering Dept., Ames, Ia. asking for specifications for drain tile and sewer pipe.

Yours, truly,

P. H. ATWOOD,

Cement Tile Manufacturer, Armstrong, Iowa.

CEMENT DRAIN TILE

With regard to the letter of William Passage of Bailey, Mich., in the January issue of *Cement & Engineering News* on page 3, referring to the failure of cement drain tile, which he made on a small hand power machine with a 1:5 mixture, the following suggestions and criticisms are offered.

It is impossible to assign a definite cause or causes for the failure mentioned without more complete information in regard to the materials and methods used in the manufacture of the tile as well as soil conditions.

To produce a good quality of tile it is necessary that the proper quantities of good cement and sand be used and mixed thoroughly, and that the tile be well tamped or pressed and properly cured, writes S. W. Stratton, director, Department of Commerce, Bureau of Standards, Washington, D. C.

The cement should pass the specifications for a standard Portland cement. The sand should be clean, free from organic matter, soft particles such as shale, clay, soft limestone, and be composed of small and large particles in such proportions that the resulting mixtures with the cement will be dense. Bank sand should be washed and if gravel up to $\frac{3}{8}$ " or $\frac{1}{2}$ " thickness of tile wall, is available, a dense mixture with a minimum of voids can be obtained by trial mixtures of various proportions of the two. A good quality of tile can not be made from sands which are too fine or contain quantities of organic matter or shale.

Just as important as proper materials is the mixing. The sand and cement should be thoroughly mixed dry before the addition of water, since the semi-wet consistency is used for tile. The addition of water with the dry materials causes the cement to "ball up," and it is only by continuing the mixing for much longer time that the cement can thoroughly be incorporated with the sand. To obtain best results in the shortest time a batch mixer for dry materials should be used in combination with a pug mill in which the water is introduced. The continuous mixer alone should not be used as it is impossible to feed the proper proportions of cement and sand continually. The moisture content of sand varies from time to time and even when using the two mixers in combination it is often necessary to continue the dry mix for double the usual period in order to distribute the cement uniformly through the sand. The time of the addition of the water is of lesser importance when a very wet mixture is used.

As much water should be used as possible and allow the immediate removal of the jacket from the tile. The proper amount is indicated by the web-like markings of cement on the outer surface. If a smaller amount is used the tile may partially dry out and will not have sufficient moisture to hydrate the cement; resulting in a "dead" mortar with little strength.

Only tile machines which pack the material uniformly and densely will make good tile and provided the proper materials are used.

An equally important factor in the manufacture of tile is the curing. Sprinkling of tile is satisfactory providing it is properly done but steam curing is more satisfactory, since the tile is continuously exposed to warm moist air which prevents drying out and insures that there will be sufficient moisture held in them to satisfy the cement. However, this process should not be depended upon to supply any deficiency due to the use of insufficient water in molding.

With good materials the above methods will result in the production of a strong, dense tile of low porosity which will give satisfaction in use.

Referring to the tile which failed it is impossible to state whether the failure is due to improper proportions or impurities in the materials without knowing more about the sand or gravel used. A 1:3½ mixture is generally used by tile manufacturers for small sized tile and even a 1:3 by some, as it is found that the output of the machine can be increased by the use of the latter by an amount which more than balances the cost of the additional cement. Using the above mixtures with sufficient mixing water the jacket may be removed immediately. A deficiency of water would necessitate keeping the jacket in place until the cement had set, resulting in a weak, porous tile. No amount of sprinkling or moisture in the earth could make such a tile dense and hard as would the use of a fraction of that amount at the time of mixing.

A five or six inch tile which has been properly made and cured can be safely used at the age of six days. This would not hold true for large tile which have to withstand earth pressures of considerable magnitude.

The relation of the size of tile to the area of land to be drained is entirely a problem in hydraulics and drainage engineering and in practice is wholly independent of the materials which are generally used in the manufacture of tile.

The manufacture of a good quality of cement drain tile, like all classes of concrete construction, requires the proper and intelligent use of good materials. Density and strength, the two main requirements, are obtained only by taking proper care in each of the various steps in the process of manufacture.

It is probable that the failure in this case is due mainly to improper manufacturing methods.

BRADLEY PULVERIZER COMPANY

We wish to advise you that we have just received an order from the Standard Portland Cement Co., of Leeds, Ala., for five GIANT GRIFFIN MILLS, which will be used on the clinker grinding end of their new addition at Leeds, Ala. This order is the outcome of the satisfactory service given by one GIANT GRIF-FIN MILL which they installed three years ago. We believe that repeat orders are the most conclusive proof of superiority, writes W. A. Gibson, publicity manager, Bradley Pulverizer Company, Boston, Mass.

It is also our pleasure to state that we have secured a repeat order from the Riverside Portland Cement Co., Riverside, Cal., for our new BRADLEY HERCULES MILLS.

The GIANT GRIFFIN MILLS which we are shipping to the Standard Portland Cement Co., will be used for pulverizing clinker. They have gone into the lead as the most economical and satisfactory pulverizer of clinker ever used in the manufacture of cement.

The BRADLEY HERCULES MILLS are to be used for breaking down clinker for Tube Mill feed. These mills break down from 110 to 130 bbls. of clinker per hour using between 150 to 175 H. P. No other mill has ever succeeded in attaining this output. There probably never has been a mill that has commanded so much attention as these have and we believe that in a short time they will succeed every type of break down mills which are now being used.

CEMENT DRAIN TILE MANUFACTURE

Mr. William Passage of Bailey, Mich., a cement tile and concrete block manufacturer whose letter we published on page 3 of the January issue of Cement & Engineering News regarding the failure he had with certain cement tile which he made on a small hand power tile machine writes us again as follows: "I note with interest the articles on pages 45 and 48 of the February issue of Cement & Engineering News in regard to the proper and only way to manufacture tile and will say that this information is very helpful to me and I will freely admit that I did not go about it right in order to properly and correctly manufacture cement drain tile as I used a 5 to 1 mixture instead of a 3 to 1. We all know that cement is one of the very best materials on earth and sometimes abused most shamefully just through the ignorance of such people as myself and if we do not learn through one another it will be a long time before we know its full value. I received printed instructions with my machine when I purchased it and I adhered to them as near as my equipment would permit. Of course I did wrong by letting tile go out of my hands before they were properly cured but I did not know at the time that I was doing wrong. I suppose the publishing of my letter in your January issue has made some hard feelings among the cement men but it was not done intentionally as far as I am concerned.

The clay people may benefit for the time being by the publication of my letter in the January issue of your paper which stated my sad experience in making cement drain tile. But the thing to do, I believe, is to leave them alone as I know for a positive fact that cement is superior to clay. Pay no attention to the clay tile manufacturers and they will then quit "knocking cement tile" as the wood stave silo builders have quit saying unkind things about cement silos in this part of the country. I know I am the cause of making plenty of hard feelings among the cement tile machine manufacturers, the cement manufacturers and the cement tile manufacturers and I am sincerely sorry. If I can not make a permanent and lasting article I don't want to use it and furthermore I do not want to sell it.

THE WATERPROOFING AND DAMPPROOFING OF CONCRETE

By Geo. P. Dieckmann

The waterproofing and dampproofing of concrete is necessary for all concrete construction. Its proper application is sometimes a difficult problem. Waterproofing has become a new branch of engineering and its development has made great improvement in recent years. Concrete is the king of all building materials and its superiority needs no further introduction. However, there is no building material known, with the exception of steel and glass, which is not subject to absorption. Water and moisture are destroying and annoying elements, and must be prevented, in order to lengthen the life of a structure and also to make it more pleasant and sanitary for its inhabitants.

Dampproofing and waterproofing represent two different features and might be divided into two different groups. All structures above grade line, not subject to water pressure, are subject to absorption of moisture and are dampproofed. All structures such as tunnels, subways, reservoirs and tanks to retain water, subjected under or against hydrostatic head, must be waterproofed.

Dampproofing is a surface treatment, and can be applied in different ways, and by different methods.

First, the application known as washes. The wash might be waterproof in itself and forms an impenetrable surface, or the same might penetrate into the pores and form a sealing waterproof bond, becoming part of the surface.

No. 1. The use of waterproofed cement or the addition of waterproof compound in powder, paste or liquid form, making a so-called cement paint.

No. 2. The use of soap and alum solution, known as the Sylvester process.

No. 3. The use of transparent waterproof coatings.

No. 4. The application of waterproof decorative coatings or stains.

No. 5. The application of bituminous or asphaltic products.

(1) The use of waterproof cement washes is the most inexpensive and its application is very simple. Waterproofed cement is mixed with water to the consistency of a paint and applied preferably only on green concrete. The treated surface should be thoroughly wetted and the cement paint applied evenly with a large brush. After the first coat has thoroughly dried, apply the second coat. Care should be taken not to allow too quick drying of the cement paint.

(2) The use of soap and alum solution is done by alternately applying hot soap solution and alum solution over the surface. This process should be repeated from four to five times and makes it, therefore, expensive on account of labor to apply so many coats.

(3) The transparent waterproof solutions are extensively used where it is desired to retain the original appearance and texture of the surface. These solutions are colorless and are made from organic compounds. They are applied on the dried and cleanly brushed surface and penetrate into the pores. After the vehicle has evaporated, the organic compound becomes a part of the surface and forms a bond with the material, making the same impervious to moisture. As this solution is alkaliproof, this will prevent staining and discoloration of concrete and brick.

(4) Where it is desired to obtain decorative effects, combined with dampproofing, a waterproofed colored stain or coating is used. This coating penetrates into the pores and forms a part of the concrete and dries without any gloss, forming no film on the surface. These coatings are very suitable for interior and exterior decoration. These waterproof coatings therefore, represent the highest development of waterproofing and artistic finish.

(5) Bituminous or asphaltic products are used very extensively for damp and waterproofing. The Gilsonite asphalts are considered to have higher waterproofing properties than the common asphalts. The same are not affected by the action of water. They are of high elastic and adhesive properties, which is of great value for the reason that the same will adhere to the surface and not become brittle during cold weather; the same might also be used as a plaster bond, allowing the bonding of new concrete to old. This material, which comes ready for use, on the market, is prepared in liquid form like paint. It is applied on a dry, cleanly brushed surface, in two coats. As the bituminous coatings are alkali and acid proof, the same are used very extensively.

As already stated above, this class of work includes all such structures which are subjected under or against hydrostatic head or water pressure. Waterproofing might be divided into two classes. (1) The Integral method. (2) The Membrane method.

The concrete might be waterproofed by the addition of a waterproof compound either in the form of powder, paste or liquid. This method demands constant supervision. The compound has to be either weighed or measured to give satisfactory results. To obtain uni-

form results with waterproofing in powder form, 2 to 2½ per cent of waterproof compound are used, or approximately 7 to 8 pounds to each barrel of cement, and then mixed thoroughly with the aggregates and the water. If paste or liquid waterproofing compounds are used, the necessary amount of paste required for a given amount of concrete is dissolved in a small amount of water and then mixed with a larger amount of water, to be used for the necessary amount of concrete. Stirring of the treated water is necessary to obtain an even solution.

The use of prepared waterproofed cement is very convenient and gives satisfactory results. The cement is already waterproofed, by the manufacturer adding the waterproof compound to the cement during its final grind, and thereby a very intimate and thoroughly incorporated product is obtained. The cement is then used the same as ordinary Portland cement and assures uniform distribution through the entire mass of concrete.

The membrane method might also be called a surface application, as already stated, but to insure greater water resistance, several layers of this compound are necessary, which are reinforced with burlap or similar material. Frequently the integral method and surface treatment are used for waterproofing.

REINFORCED CONCRETE PIER

A \$650,000 Structure to Be Erected at Terminus of Municipal Railway

A large amusement pier is to be constructed on the ocean beach at San Francisco, Cal. It will be located at the terminus of the municipal railway adjoining the great highway, south of the Cliff house. At the location given there is a depth of about 18 feet of water at a distance of about 1,000 feet seaward from the Great Highway.

The pier will consist of reinforced concrete piles carrying reinforced concrete beams and floor slabs. The piles will be 22 inches in diameter and will have a mushroom base. They will be jetted down into the sand to a depth of not less than 20 feet. The head of the piles will be formed by means of haunches upon which will rest the reinforced concrete flow beams. The piles will be spaced 18 feet centers east and west and 20 feet centers north and south. This spacing is recommended because it allows a large waterway for the waves. The deck of a pier will be 21 feet above high water. Aside from the piles necessary to support the pier proper, there will be additional piles to take care of any concentrated loads caused by the superstructure. It is estimated that the cost of the substructure will be \$350,000 and that it will take at least ten months to complete it.

The superstructure will be a combination of steel and wood with stucco walls properly weather proofed. The roof will be tile or other fireproof covering. The cost of the superstructure will be about \$300,000. The superstructure embodies four units, surrounded by a double deck promenade. Its dimensions will be 750 feet long and 150 feet wide. In the center will be a tower, which has been treated architecturally as the main feature of the design. It is 30 feet square and 150 feet high, surmounted by gardens and the smaller open air concession booths, forming a Spanish Patio. Adjoining the Patio on the land side will be located the amusement pavilion, 116 feet by 204 feet and 65 feet high, and on the upper side will be a large pavilion containing a dance hall and theater. As planned the former will be 116 feet by 145 feet. The theater will have a seating capacity of 800. A cafe, semi-circular in form, with seating space for 800, will

be situated at the ocean end of pier. One of the important features of the plan is the treatment of the two-story promenade, the lower portion of which will be entirely enclosed with glass, while the upper deck is left open.

The style of architecture is Spanish Renaissance. The tower will be somewhat similar to the famous Giralda Tower at Seville, and around it will be grouped different adaptations of Spanish architecture. The elevation facing the Great Highway will be decorative with its entrance arch flanked by pylons and the administrative wings. The approach to the main entrance will be by means of an ornamental bridge spanning a portion of the beach and connecting the Great Highway with the esplanade.

The pier will be constructed for the Ocean Pier Amusement Co., Merchants' National Bank Building, San Francisco. Coats & Traver, Head Building, San Francisco, are the architects, and Edward Crowley is the engineer.

THE SEVENTH ANNUAL CEMENT SHOW

The seventh annual Chicago cement show, held in the Coliseum February 12 to 21 under the able management of J. P. Beck has surpassed in attendance and exhibits any previous exhibition of the kind in the country's history. This may be credited to the fact that the officers of the Cement Products Exhibition Company on this occasion have been able to put into practice the lessons gained by previous show experiences. The exhibitors likewise have learned how more effectively to arrange their displays.

It was the most practical and useful show that has ever been offered to the public and every exhibitor was well pleased and all have declared they will come again next year. A great number, also, stated that they would take larger space next year. Some of those who called at the Cement & Engineering News booth and who did not have exhibits this year on account of not making application in time for space, or who were too busy at home, declared that they made a big mistake by not exhibiting this year, for instance the Zaglemyer Cast Stone Block Machinery Company, Bay City Mich., McCoy Concrete Silo Farm Company, Pittsburg, Pa., and the Ubbink Steel Sidewalk Form Company, Port Washington, Wis.

NOVO GASOLINE ENGINES.

Catalogue No. 614 of the Novo Engine Co., Lansing, Mich., is about as complete a catalogue of gasoline engines and outfits as has ever been issued. Small units of gasoline engines become more and more the custom in preference to large steam engines, which latter require expensive boiler installations and frequently mean a complete shutdown of the whole factory, whereas in case of smaller units only part of the business is discontinued. The Novo Co.'s catalogue describes numerous types of stationary and portable engines among which large and small manufacturers can not fail to find the type most suitable to their needs.

CONCRETE CRANE PONTOON

A reinforced concrete crane-pontoon, 30 m. long by 13 m. wide, fitted with a motor and screw, and capable of being navigated by its own power, has been constructed at Marseilles. It is to carry a crane 10 m. high, with an overhanging or unsupported length of 10 m., able to support a load of 30 tons. The pontoon has double sides, protecting it against the influx of water should the outer skin be damaged.

MAKING THE TRUCK PAY

By H. D. Pratt, Engineer, Link-Belt Company, Philadelphia, Pa.

The motor truck has come to stay. Its ability to carry bulk material long distances in quantities unheard of ten years ago, and at a high rate of speed, makes it possible to materially reduce the cost of transporting large quantities of stone, coal, sand, gravel, etc. The speed of travel is high as compared with the horse-drawn vehicle. The unloading is automatic, the body being dumped by the mere turn of a lever by the truck operator. In many cases the truck is loaded from an overhead chute, but more often the material to be moved lies on the ground in storage piles, not only in regular storage yards, but in streets, roads and wherever most convenient to store. The

nature of the material to be handled, trim and feed to the loader. This combination will load the truck at a cost of $2\frac{1}{2}$ cents to 5 cents per ton, the higher cost being that of handling crushed stone, with coal at the low end, and sand and gravel following in order. The saving of about 5 cents per ton thus effected is a large item in these days of close margins and competition, and marks the loader as a useful and necessary adjunct of the motor truck.

There is also a growing demand for a further combination of truck and loader,—namely: a truck with loader elevator mounted on the rear end of the body, arranged to lower into a storage pile when the truck is backed up to it, and also to raise clear of the ground when not in use. The elevator is supported independently of the dumping body, and is driven through a clutch by a connection to the truck transmission.



Portable Wagon and Truck Loader, Manufactured by the Link Belt Company, Philadelphia and Chicago.

loading of this material from ground storage piles becomes a different matter. The high cost of loading auto trucks with material carried on ground storage is one of the factors which have retarded the sale of trucks for this work.

The truck which is so quick and convenient for handling several tons at a load, must necessarily be high to hold the load. Shoveling by hand means that the truck spends more than half its time waiting at the storage pile to be loaded, and between trucks the shoveling gang is idle. A good average day's work for a shoveler is 20 tons of gravel, less of stone, and slightly more of sand. Not only is the truck standing idle while being loaded, but the loading by hand costs 8 to 12 cents a ton. Here is a bad leak in what should be an up-to-date and efficient job of handling.

The portable wagon and truck loaders effectively stop this leak. The illustration herewith shows how. A bucket elevator is mounted on large wheels, and with power supplied by a motor or gasoline engine, will load sand, gravel or coal at the rate of a **tone per minute**. The truck driver trims the truck with a shovel, and one, two or three men, depending on the

This combination results in a truck which can be loaded by its driver with or without a helper in a few minutes, and does away entirely with the necessity for a loader-operator who is idle between trucks.

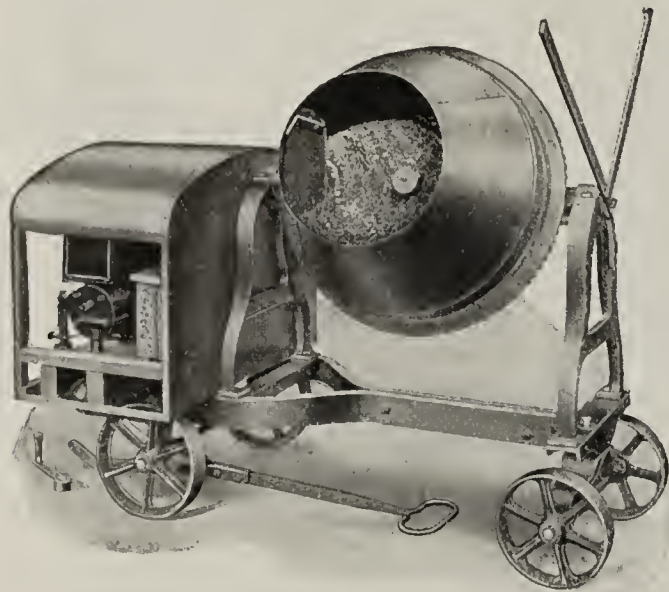
The loaders described above are made by the Link-Belt Company, Philadelphia and Chicago.

A NEW CERESIT CATALOG

Ceresit Waterproofing Company, 149 Westminster Bldg., Chicago, Ill., has issued to the trade a unique waterproofing booklet thoroughly descriptive of the problem of waterproofing concrete, and its accomplishment with Ceresit. The booklet is in the form of a number of small units bound together with a large cover and the topics are treated in individual fashion. The use of Ceresit under widely varying conditions in many states and countries is described in detail and its effectiveness attested to in letters from contractors and architects. Every concrete contractor needs a copy of this book for his permanent working library and the Ceresit Waterproofing Company at the above address will be glad to send one on application, mentioning Cement & Engineering News.

MIXING OF CONCRETE

The mixing of concrete should be done as rapidly as possible and should not be mixed in larger quantities than is required for immediate use. A prominent paving company in Dallas, Texas, has made it a point to exercise great care in the mixing of concrete and see that it is thoroughly mixed and not permitted to appear raw when deposited in the forms. The materials should be mixed wet enough to produce a cement of such consistency as will flow into the forms and about the metal reinforcing, when used, and which, on the other hand, can be conveyed from the mixer to the forms without separation of the coarse aggregate from the mortar. In other words, the consistency of the concrete should be soft and wet without being sloppy, and in general should be such that after dumping the concrete into the forms it may be consolidated and worked into places with spades and shovels, and a slight quaking secured with little or no effect. A good concrete worker can tell whether the concrete permits of easy tamping. The mixture should be moderately wet. Care, however, must be



Van Duzen Concrete Mixer.

taken that the concrete is not too wet, so that the stone and sand settle under the water during its transformation to the forms, although what is usually known as the wet mixture should be used for all reinforcement work.

For ordinary work, concrete should be mixed wet-soupy. From the standpoints of quality, ease of handling and manipulation, resulting finish and the cost of surfacing, there is absolutely no question as to this point. This choice of wet concrete applies to walls, bridges, reinforced buildings, etc., but for sidewalk and pavements economy demands a dry mixture requiring tamping in order that the workmen applying the finish may follow as quickly as possible after the depositing of the concrete.

No concrete should be placed until it is definitely determined that the forms are correct and properly braced. It is cheaper to delay the work than to cut out work already done. Concrete should be placed as quickly as possible after mixing and not be disturbed thereafter. The placing of concrete is one point where the material is abused to the greatest extent. We take great care of a green brick wall, but do not hesitate to walk over and conduct operations over concrete which has not reached its final step, thereby destroying the surface of the concrete for all time.

Various types of work naturally demand various types of machinery and arrangement, but in general it may be said that too large a mixer is not economical. Use preferably nothing smaller than a $4\frac{1}{2}$ cubic

foot mixer, which will deliver up to fifty yards of mixed concrete per day. Only use a larger mixer than this if the work will justify it. Also in general it may be stated that each batch from the mixer should be handled as a whole as nearly as possible to the place of deposit. The wheelbarrow is no longer the primary method of transportation of concrete. There is no doubt as to majority of opinion being in favor of batch mixers, but whatever type adopted it would be well in the long run to make sure that the engine is of sufficient power to handle "real" work with ease.

The Dallas company uses a $4\frac{1}{2}$ cubic foot batch mixer wherever possible, having found that this size of machine is easily moved by its crew from and to different parts of the work during its construction. A number of batch mixers of this size could be profitably employed on large work.

In concrete curb and gutter work, this concern easily averages 450 lineal feet or 30 cubic yards per day. With a crew of five feeders and three wheelers it shovels direct into the mixer, but later on the company will add to its mixer an automatic loader which is now out and increase its capacity nearly 50 per cent. The average time consumed producing each batch is two and one-half minutes, most of which is taken up with the loading. Before the adoption of machine mixing, the firm secured very uniform results by the hand methods, but at a considerably greater cost. Its mixers are of the "Big-an-Little" type, and were furnished by the Van Duzen, Roys & Co., 341 Dublin Avenue, Columbus, Ohio, whose advertisement appears in this issue of Cement & Engineering News.

TO PROTECT JOINTS AND CURBS

The Trussed Concrete Steel Company, of Detroit, Mich., has just placed on the market two new products for street work, one of them an armor plate for expansion joints in concrete paving, and the other a curb bar for the protection of the edge of concrete curbs.

The Trus-Con armor plate is made in widths of 2 or $2\frac{1}{2}$ inches, and has welded to it anchor bolts at intervals of 18 inches. These anchor bolts extend into the concrete and thoroughly bond the plates to it. A sheet of tarred paper, or other similar substance, is placed between the two plates when the joint is set in place, the paper extending the full thickness of the slab.

The Trus-Con curb bar forms a protection for the exposed corners of the curb, and its design is well shown in the accompanying illustration. These bars are made from medium open hearth steel and are galvanized. The plate is $\frac{1}{4}$ inch thick, with a periphery of $2\frac{1}{2}$ inches. The anchor bolt is 7-16 inches in diameter by 4 inches long. These bars are made in standard lengths of 8, 10 and 12 feet.

PETOSKEY CRUSHED STONE COMPANY

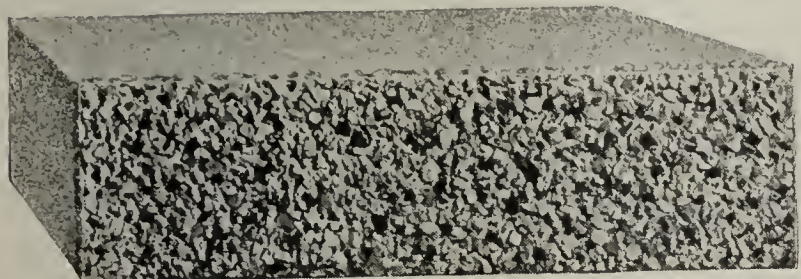
The Petoskey Crushed Stone Company's plant at Petoskey, Mich., has been shut down for the winter, after a most prosperous year during which 170,000 tons of rock have been crushed and \$22,000 paid out to the 35 employes. The working year is from the middle of March to the middle of December.

Thirty thousand tons of the rock have been used on streets and turnpikes, and 140,000 for use in manufacturing pig iron and cement. The company ships to all parts of Michigan and Wisconsin.

A number of men will be kept at work overhauling the machinery and making other preparations for next year's run.

CEMENT BRICK WITH GRANITE FACE

To reproduce on the face of cement brick, without the use of acids or other chemicals, all the natural texture, color, and beauty of granite, marble, feldspar, or other stones capable of giving attractive surface effects, is an achievement now credited to the Helm Press Brick Machine. This machine is made by the Helm Brick Machine Co., 11 Bank Bldg., Traverse City, Mich.; and the accompanying illustration gives a fair idea of the appearance of a Helm press brick of granite face texture.



Helm's Press Brick of Granite Face Texture.

The texture may be coarse or fine, rough or smooth. The face is readily waterproofed. Moisture will show on the face no more than on the most expensive clay face brick. The face is even stronger than the body of the brick or block. The edges and corners are sharp and strong.

Beautiful, distinctive, and attractive textures are given to the commonplace surface of brick and block made from ordinary cement, sand, and gravel at the mere cost of an hour's labor to a thousand brick.

Enormous profits are available. A thousand granite face brick, which can be made for about \$8.00, will sell at about \$16 to \$20. Cheaper grades pay big profits, too.

This process is so simple any novice can handle it successfully and produce effects as beautiful as that here shown. In every community there is a field for the introduction of this beautiful product, so that the Helm Press and the facing process that goes with it are well worth looking into. Write the Helm Brick Machine Co. at the above address.

WOLVERINE PORTLAND CEMENT

The Wolverine Portland Cement Company, of Coldwater, Mich., has had a prosperous year, after several very lean ones. The company's production has been large and it has realized about 20 cents a barrel over the price which prevailed last year. The company's earnings for 1913 are estimated at \$100,000, or 10 per cent on its capital stock of \$1,000,000. The greater part of the earnings will be put back into the plant, however. With another year like the present all of the improvements planned will have been completed and the company will be in position to resume dividend payments. Its plans are being brought up to the highest state of efficiency and these improvements will enable the company to cut the cost of manufacturing very considerably, and the stockholders will eventually reap the profit. The modern rotaries to be installed will save at least 10 cents a barrel on the cost of production. Devices for handling the clinkers and automatically packing the cement, and new grinding machinery will lop off a few more cents per barrel.



Persistence

misguided is well represented by the man who was jailed three times for the theft of the same horse.

Persistence well directed, we believe, is confidence in having a good thing and continuously striving until the reader is sufficiently convinced to make a trial.

Goodrich

LONG LIFE MAXECON

CONVEYOR BELTS

reduce tonnage costs.

Our persistency in continuing to impress upon the readers of this publication the confidence we have in our ability to effect maximum economy and efficiency is but the outgrowth of years rich with experience in the manufacture and proper adaptation of our products.

Elevator Belts	Packing
Transmission Belt	Valves
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Everything that's
Best in Rubber*

Among The Cement Mills

PUZZOLAN MIXTURES TESTED FOR OREGON ROADS

It has been known to scientific experimenters for some time that if certain volcanic materials be reground with Portland cement, the resulting blend can be used to make concrete which in point of strength is equal or superior to concrete made in the usual manner. A material saving is effected in cost, especially where cement is high in price, and a further advantage is gained in greater resistance to certain destructive agencies which attack concrete in some locations.

From the known chemical composition of certain volcanic materials abundant in Oregon, the writer inferred that possibly some of them might have good results when blended with cement, and accordingly undertook a series of tests at the civil engineering laboratory of the University of Oregon. These tests have been carried on since last October and are still in progress. Already a few blends have been found which give results, both in tension and compression, superior to those obtained from the same cement without blending, writes E. H. McAlister, Dean of School of Engineering, University of Oregon, in the October issue of "The Cement Era."

Considering the very extensive tests made at Los Angeles and other places, and the long practical experience with blends in Europe, extending over a period of more than 30 years, and in view of the still more recent adoption of blends by the United States government for the construction of important dams, the only question that remained in the mind of the writer was whether the materials easily available in Oregon would prove satisfactory when reground with Portland cement. The test made at the University of Oregon have shown that one material which is of wide distribution in the Willamette valley gives very excellent results, while other materials, available in certain localities, are also suitable. A brief account of these tests will now be given.

The proposed stone was first crushed to fragments not exceeding one-twentieth inch in diameter. These fragments were then mixed with cement in definite proportions by weight. The mixture was then ground to a fineness somewhat exceeding that of the original cement so that 90 per cent would pass through a No. 200 sieve. The finely-ground mixture is for convenience called a "blend," and is subsequently used in the same manner as cement. For brevity, the blends are designated by letters, the letter "A," however, designating pure Portland cement. Among the blends experimented with, the following may be noted:

- "A"—Pure Portland cement.
- "B"—1 part cement to 1 part "Eugene puzzolan."
- "C"—2 parts cement to 1 part "Eugene puzzolan."
- "D"—1 part cement to 1 part diatomaceous earth.
- "E"—2 parts cement to 1 part diatomaceous earth.
- "F"—1 part cement to 1 part "Grants Pass puzzolan."
- "H"—2 parts cement to 1 part slag.
- "K"—1 part cement to 1 part "Clackamas puzzolan."

The stone designated above as "Eugene puzzolan" was obtained at Eugene, but is abundant in the Willamette Valley. It is needless to say that the term "puzzolan" does not adequately describe its mineralogical character; its chemical composition is similar to that of the tufa used on the Los Angeles aqueduct. The diatomaceous earth was taken from a deposit near Eugene; it is an excellent material for this purpose, but so far such deposits have been found only in a few

places in Oregon, and it would not therefore be generally available. The Grants Pass and Clackamas "puzzolans" are similar to the Eugene puzzolan, but not identical. The slag in blend "H" is a blast furnace slag from Oswego. It is sometimes termed an artificial puzzolan, and similar slags are often used in Germany.

Cement is almost never used pure in practical work; it is mixed with sand or stone screenings to form mortar or concrete. Accordingly, the practical question with reference to these blends is this: "What is the relative strength of mortars made with the blends and of similar mortars made with the same cement not blended?" To determine this question, both tensile and compressive tests have been made. The tension briquettes were composed of 1 part cement or blend to 3 parts sand by weight.

The sand used was crushed quartz, screened to the same size as standard sand. It is of very uniform character, but gives results in tension that are uniformly about 80 per cent of those obtained with standard Ottawa sand; accordingly all the tension curves, including curve "A," have been reduced to the basis of standard sand, to facilitate comparison by those acquainted with cement testing. The compression tests given below have not been reduced to the basis of standard sand, because the relationship is not known for compression.

All the blends shown surpassed the cement in tensile strength at the end of 28 days. Some typical compression tests are as follows:

Mortars similar in every respect to those used in the tension briquettes, age 2 months:

	lbs. per sq. inch.
With cement	3030
With blend "E"	4210
With blend "H"	4210

Mortars similar to tension briquettes, except that river sand was used instead of quartz; age 2 months, 1 week:

	lbs. per sq. inch.
With cement	4140
With blend "D"	3010
With blend "E"	5760

Mortars composed of 1 part cement or blend to 5.22 parts sand by weight; the sand was coarser than the above; age, 2 months:

	lbs. per sq. inch.
With cement	2526
With blend "B"	2125
With blend "C"	4240

From the results quoted above, and others not here quoted, it has been found that blends composed of equal parts by weight of cement and puzzolanic material have somewhat less strength in compression than the original cement, but that blends composed of 2 parts cement to 1 part puzzolanic material by weight have far greater compressive strength than the original cement. However, it must be noted that all the puzzolanic materials experimented with are lighter than the cement, so that equal parts by weight give an excess of puzzolanic material by volume, and the results obtained indicate that 53 per cent by weight of cement to 47 per cent "Eugene puzzolan" will give compressive strength equal to that of the original cement in either 1:3 or 1:5 mortars; while equal parts by volume of cement and diatomaceous earth will surpass the original cement. Blend "E" is practically equal parts by volume, the diatomaceous earth being only about half as heavy as cement. On the Los

Angeles aqueduct, the blends chiefly used were composed of equal parts by volume of cement and tufa.

In corroboration of his own experiments, the writer wishes to refer in this place to experiments made by Dr. W. Michaelis, Jr., of Chicago, on blends made with cement and puzzolanic material obtained on the Columbia river. After describing his experiments, Dr. Michaelis says:

"The experiments described in the foregoing show that the puzzolana used in these tests results in a commercial product of excellent qualities, if reground with Portland cement in the proportions of 2 parts of Portland cement to 1 part of puzzolana, or even of equal parts of both ingredients. The latter mixture has been found to be equal or even superior to pure Portland cement, both in tension and compression, in all lean mixtures, which correspond with actual working conditions. Richer mixtures are only rarely used, and should they be desired, the puzzolana-Portland cement mixture will prove to be of especial advantage on account of the greater saving involved. In rich mixtures, the pure Portland cement has been found to be slightly superior in strength during the first months, but at the end of a year and at all subsequent dates, the puzzolana-Portland cement mixtures mentioned are equal to pure Portland cement also in these rich mixtures."

Up to the present time, the greater number of experiments conducted by the writer have been with the "Eugene puzzolan," because of its known wide distribution. However, other materials, available in special localities, are under investigation, and some of them give promise of very excellent results.

As to the expense of grinding these blends, the itemized costs of the three mills used on the Los Angeles aqueduct are available. In comparing these costs with the corresponding items in Oregon, the writer

sees no reason why any of the items should be greater in Oregon than in California, with the possible exception of the cost of power. The items are: Cost of power, cost of quarrying, cost of mill operations, and general expense, including labor, live stock, etc. The total of these items is 37 cents per barrel, of which the power item is 10.5 cents, and the other items 26.5 cents. In Eugene, the California power cost can be duplicated, or practically so, and doubtless the same can be done in many other localities, but not in all. Probably a fair average cost in Oregon would be 40 cents per barrel. The California costs were obtained on relatively small mills, turning out an average of about 16 barrels per hour, or enough in 10 hours to lay about one-eighth mile of concrete road according to the California specifications.

In any locality where material equal to the "Eugene puzzolan" is available, the cost of a suitable blend per barrel would be figured by taking 53 per cent of the cost of a barrel of cement and adding to that the cost of blending, say 38 to 40 cents. For example, the cost of cement in Eugene in carload lots is \$2.38 per barrel, net. Allowing for a 3-mile haul from the railroad to the location of the plant, at 20 cents per ton-mile, the cost of hauling per barrel would be 10 cents, making a total of \$2.48 per barrel for the cement. The cost of the blend would then be as follows:

Cement, .53 barrel, at \$2.48.....	\$1.315
Total cost of blending, say.....	.38

Cost of blend per barrel.....	\$1.695
-------------------------------	---------

At Portland the cost of such a blend should not exceed \$1.44 per barrel, on the basis that the cost of cement at the grinding plant is \$2.00 per barrel.

It is proper to remark that the cost of the necessary grinding machinery is considerable, so that in order

FLINT-RIM

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For handling abrasive and gritty materials

The most durable and economical wheels on the market.



These wheels are made by a special process, perfected by us after many years of investigation and experience. They give a hard, smooth bearing service, free from sand. This surface extends to a depth of 1/4-inch to 1/2-inch and prolongs the life of the wheel far beyond that of ordinary cast iron. The life of the sprocket wheels made by the >FLINT-RIM< process is prolonged because it not only insures but *maintains* the correct diameter and pitch.

Write to us for records of service of >FLINT-RIM< wheels, and prices on our

MANGANESE STEEL CHAINS

The following Catalogs will be mailed upon request

No. 90 General Price list

No. 108 >FLINT-RIM< Wheel list

No. 83 Elevators and Conveyors

No. 79 Belt Conveyors

LINK-BELT COMPANY

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New York.....	290 Broadway
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Minneapolis.....	Link-Belt Supply Co.

to keep the cost of grinding low it is necessary that the first cost of machinery be distributed over a large total output, extending over several years, or preferably over the economic life of the machinery. This would be possible, for instance, in case any county should enter upon a systematic plan of building concrete highways for a series of years.

It should also be stated that the economy of blends results from two sources: Nearly half of the cost of cement at the factory is saved, and nearly half of the freight bill is saved. The latter circumstance explains why it would not in general be economical to have the blends ground at the cement factory—a suggestion sometimes advanced.

MEDUSA WATERPROOFING WINS SUIT

A decision has been handed down by Judge Landis in the United States District Court for the Northern District of Illinois, Eastern Division in the case of the Medusa Concrete Waterproofing Company vs McCormick Waterproof Portland Cement Company and Sydney T. Sjoberg, sustaining patent No. 851,247, April 28th, 1907, "Waterproof Portland Cement and Process of making same," and a decree has been entered sustaining this patent and holding that the McCormick Company are infringers thereof.

HURON CEMENT COMPANY

The plant of the Huron Cement Co., of Alpena, Mich., has reopened after a temporary shut-down, due to the caving in of the roof over part of the plant. Nearly a full force is now working and the plant will be run close to capacity. An official has been quoted as declaring that the concern was never in a more prosperous condition and despite the fact that business of the past year broke records it is expected to be even greater during the coming year. It is expected that the new steel dock being constructed for the company will be ready when navigation opens and another stone-carrying steamer will be put on for the concern's convenience.

SIFTING OF PORTLAND CEMENT

In view of the considerable discrepancies which are known to exist in the sifting values of standard 200-mesh sieves as obtained in the sifting of Portland cement the Bureau of Standards has recognized the necessity of supplementing the measurements heretofore made on the sieve cloth by actual sifting tests.

Thus an approximate "correction" will be determined for each sieve by means of which its actual sifting value can be reduced to some definite standard, writes E. B. Rosa, Acting Director of Commerce, Bureau of Standards, Washington, D. C.

Prior to the adoption of this plan, however, the Bureau asks your co-operation and assistance in determining a standard, and offers you an opportunity to determine the corrections to your own sieves without payment of fee. If you will send us the B. S. numbers of the standard 200-mesh sieves in your possession, a sample of carefully mixed cement, sufficient for three tests on each sieve will be sent you. As the determination of the standard will be based on all the results obtained, you are requested to send us the results of your individual sifting tests together with the number of the sieve upon which determined as soon as possible after receiving the samples.

It is suggested that your most careful and experienced operator perform all the sifting operations on these tests, as uniformity in results on any one sieve is of more importance than the possible elimination of

personal equation. It is also suggested that in following the standard specifications for sifting special care be taken to turn the sieve frequently in order to eliminate the effects of uneven distribution or of the direction of the screen wires.

Under separate cover, a copy of Technologic Paper No. 29 is being sent you. This paper contains the standard specifications for sifting and other information bearing on the cooperative tests here proposed. Further information regarding the purpose or execution of these tests will be gladly furnished upon request.

PROGRESS IN THE ENGLISH CEMENT TRADE

In the October issue of this journal we referred to the manifest indications of increasing prosperity in the cement trade. In that number we were able to record the declaration of the first dividend paid to the ordinary shareholders of the Associated Portland Cement Company since its formation. The hopefulness for the trade in general inspired thereby is given support, by the developments in connection with the Ship Canal Portland Cement Manufacturers' works at Ellesmere, Cheshire. These works are erected on an estate of sixty acres having a frontage of 1,000 feet on the Manchester Ship Canal, another frontage on the Shropshire Union Canal, and the further advantage of the London and North-Western and Great Western Railways. The transport facilities are exceptionally good and, in addition to ample supplies of limestone at Orme's Head, so excellently situated on the coast that a 1,000-ton steamer can be loaded in 40 minutes direct from their own bins, there are extensive shale deposits adjoining the railway line between Llandudno and Colwyn Bay. To transfer these raw materials to Ellesmere Port is simple and inexpensive.

The present production of cement in this country is about 3,000,000 tons per annum, and in every branch of constructional work its uses are boundless. It will be remembered that when addressing the shareholders of the Associated Portland Cement Company recently, Lord St. Davis ventured on a forecast of an early and steady rise in prices. [Stone Trades Journal, London, W. C.]

FUTURE ECONOMIES IN CEMENT MANUFACTURE

The future economies in cement manufacture will be found: (1) In reducing the number of men employed by simplifying the arrangement and reducing the number of machines required and increasing their size; (2) By reducing the power required to produce a barrel of cement; (3) By reducing repair costs and shut-downs as a result of improving the detail design of the machine parts and standardizing all similar parts; (4) By saving the escaping dust both inside and outside of the plants; (5) By still further reducing the loss of fuel in the rotary kiln by reducing stack temperatures and utilizing the heat in the discharged clinker by heating the air used for combustion of fuel in the kiln, says Paul C. Van Zandt, of the Allis, Chalmers Co., in a recent address before a university Engineering Society.

There are other economies and improvements needed but these represent a few of the important problems confronting the cement plant engineer at the present time. With the prices of other materials advancing in the past 10 years, cement has been steadily decreasing in price until the point has been reached where the price must advance or else the cost of manufacture be materially reduced if the existing plants are to make a living profit.

RECEIVER BRINGS SUIT

William F. Allen, receiver of the Seaboard Portland Cement Company, recently brought suit against Edwin Thomas, of Catasauqua, and George W. Roydhouse, of Philadelphia, Pa., former directors of the defunct concern, in the United States District Court in Philadelphia, for the recovery of \$4,000,000. Mr. Allen was appointed receiver for the company on April 26, 1911, on a stockholders' bill in equity filed in the District Court.

According to the bill of complaint, the two defendants were partly responsible for the Seaboard company's failure, and the receiver now seeks to hold them responsible for the losses incurred to the creditors and stockholders. It is averred that the liabilities amount to \$2,000,000 more than the assets. The suits have been instituted on the grounds of neglect of duty by the defendant directors, with the result that funds and property of the cement company were wasted and mismanaged, through their failure to attend board meetings and supervise disbursements of funds and investments.

BONNER BRAND CEMENT CO. WILL BE REORGANIZED

The real estate of the Bonner Brand Cement Company at Bonner Springs, Kan., was placed in a receivership on January 3rd by Judge Hugh Smith in the third division of the Wyandotte county district court. Application for the receivership was made by the Banking Trust Company of Kansas City, Kan., on behalf of the stockholders, who own the paper of the company. Bert Cable was appointed receiver, both parties to the suit agreeing.

The receivership is a friendly affair, the stockholders say, and was necessary to effect a reorganization of the company. The reorganization will be completed this month, and a new charter will be asked.

The Bonner Brand company has a 1,200-barrel plant near Bonner Springs, Kan., which has been running at capacity for the past year. The plant emerged from a federal receivership three years ago, and has been prospering since, according to reports. The present receivership came with the foreclosing of a deed of trust for \$100,000, which has been spent since the federal receivership was dissolved. The money was spent for new machinery necessitated by a change of fuel. The plant had been operated with oil and gas, but a change to coal had to be made when the prices of the other fuel soared. The stockholders were assessed for the payment. Those who paid in joined in applying for the receivership.

A WESTERN CEMENT POSSIBILITY

After a conference of those interested in the mammoth white cement properties at Gardiner, Montana, it was unofficially announced that the cement mill there will be running by June 1. It is understood a Chicago capitalist has made arrangements to purchase the stock of some of those who have been at the head of the warring factions and that with this deal closed things will progress smoothly.

The cement deposit at Gardiner is said to be the only large deposit of true white cement in the country. Hundreds of thousands of dollars have already been spent in building a bridge and railroad track to the property and almost completing the first unit of the mill, but legal entanglements have always stopped work before the cement could be turned out.

United States Senator T. J. Walsh, Colonel Nolan and other prominent men of the state and capitalists of Chicago are now at the head of the company. It is announced that nothing can now stop the development of the fields.

The Negley Patented Excavator

Performs All Slack Cableway Operations

It has the fast and the slow dumps combined in one machine. It can be dumped at the anchor end of the cable-way. It only requires 3½ feet for clearance, giving good storage. It dumps without extra power, and with no stress on equipment. It operates with the minimum of working pressure, efficiently. It is a standardized machine, having no expensive special parts. It has a carriage, which is rigidly connected to the bucket. It has a two-piece bucket, open on the top, and easy to load. It deposits the material close to the power mast or tower.



This picture shows our excavator operating in Iowa, where it is doing efficient and economical work, loading cars for shipment.

Several kinds of equipment has been used by this operator, but this machine is giving the best results he has yet obtained.



The above picture shows the Negley Patented Excavator at work in Indianapolis, operating on boulevard construction, where four of these machines are employed, this one being equipped with a bridle, as the material runs shallow, and frequent changes are necessary in shifting the anchor end of the cable-way.

This demonstrates the broad adaptability of this excavator, to all conditions of excavation, where the slack cable-way system can be used.

Indianapolis Cable Excavator Company

New York Street and Beauty Avenue

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Representatives for Arizona, California and Nevada

STANDARIZATION OF THE NO. 200 MESH SIEVE

Referring to the letter by Mr. Bernard Enright which appeared on page 300 of the October issue of Cement & Engineering News on the standardization of the No. 200 mesh sieve, I would say that the test of fineness of cement as shown by sieves is not now considered of so much importance as formerly, because it is recognized that the real cementitious value of cement is dependent on the fineness of grains smaller than the finest sieve.

On the other hand, the object of any test is to show accurately the quality of the material, and our apparatus should be within the limits of accuracy needed to indicate this quality. While accurate calibration of each independent sieve would be of considerable value, especially so long as the sieve is practically new, I am of the opinion that results of sufficient accuracy for the purpose can be obtained by accepting the sieves from wire-cloth manufacturers by requiring them to maintain a very high standard. Uneven or imperfect mesh should be rejected and frequent special tests should be made to indicate to the manufacturers that accurate weaving is essential.

SANFORD E. THOMPSON, Boston, Mass.

CANADIAN CEMENT PLANTS

W. H. Todd, General Sales Manager, Canada Cement Company, Montreal, writes us as follows:—

"Beg to advise that, owing to dullness of business, we have decided to close down, for the balance of the year 1914, or until further advised, Plants No. 6, Marlbank, Ont., No. 7, Lakefield, Ont., No. 9, Shallow Lake, Ont., and No. 10, Calgary, Alta.; therefore, will not be prepared to receive shipments of empty bags returned to any of these mills after February 1st. Returns made to any of our other mills shall have prompt attention."

FRANK M. TREXLER

Frank M. Trexler of Allentown, Pa., a brother of Colonel Henry C. Trexler, president of the Lehigh Portland Cement Company, Allentown, Pa., was appointed Superior Court judge by Governor Tener, filling the late James A. Beaver's place.

NEW STEAM SHOVEL

The Dexter Portland Cement Company, Nazareth, Pa., has just installed a Model 36 Marion revolving steam shovel which is giving entire satisfaction. It was manufactured by the Marion Steam Shovel Company, Marion, Ohio.

OLYMPIC CEMENT COMPANY

The Olympic Portland Cement Company advise us that the Model 60 Marion steam shovel which they operate in their quarry at Kendall, Washington, for loading crushed rock is giving splendid satisfaction and that they are more than pleased with it.

INSTALLING ELECTRIC DRIVE.

The Dewey Portland Cement Co., Kansas City, Mo., is installing electric drive in its mill at Dewey, Okla. The power plant will be equipped with a 1,125 kv.-a. generator, 150 kw. motor-generator set and switchboard; while two 75 h. p., four 20 h. p. and two 10 h. p. motors will be employed for driving the machinery throughout the mill.

MEDUSA WHITE PORTLAND CEMENT.

A new catalogue has just been issued by the Sandusky Portland Cement Co. of Sandusky, Ohio, describing the various artistic uses to which their white Portland cement can effectively be put. The pamphlet contains dozens of illustrations of ornaments and buildings for which Medusa White Portland Cement has been used and is well worth sending for, as it will give many pointers to contractors interested in the artistic application of cement.

W. B. CADY

W. B. Cady of Rio Riedras, Porto Rico, is now chemist for a large sugar company and writes us that he would like to connect with some cement company.

SAND AND GRAVEL WASHER

As every worker in concrete knows, or should know, nothing is so important as clean sand and gravel, and these are often hard to get. There is a machine for washing sand and gravel that has solved completely this problem for every concrete man. It is made by the Stocker Concrete Material Washer Company.

The Stocker Gravel and Artificial Stone Company has been operating for years, and, feeling the necessity of a device to clean gravel and sand, Mr. F. Stocker undertook to construct one and finally succeeded in inventing the machine, thereby supplying a want generally felt in the concrete industry.

This machine has been tried thoroughly and found to be practical and advantageous in every respect. Its construction is very simple and strong, most durable and comparatively cheap. It can be readily operated by anyone, since there are no complicated parts to get out of order.

The machine can be easily transported from place to place if desired. This feature is particularly advantageous in case of bridge building, pier and abutment work; in such case the machine can be moved to creek or river bank where sand and gravel can be found in abundance nearby, however usually too much mixed with mud, dirt or other impurities to permit their use; but if washed right on the spot the cost of hauling the material from a distance, sometimes for miles, is saved.

The washer is all metal, the end frames are cast iron, the revolving drum is of No. 16 sheet steel. On the inside of the drum are riveted angle iron bars, to which steel strips are riveted, forming an elevator carrying the material to the upper part of the drum, whence it drops into steel chutes, which are stationary and at a fixed angle, conveying the material forward; from the chute it falls into water at bottom of the drum, taken up by the elevator and dropped into the next chute and so on until the washed material finally is discharged from the last chute.

The machine can be operated with a 2-horsepower gasoline engine, is well made, strong and durable.

The capacity of the machine is about 75 tons per day of 10 hours, washing sand and gravel containing 20 per cent of clay (result of actual tests) and will require only from 10 to 15 gallons of water per minute. Then, too, the price is within the reach of all. Write them today for prices, catalogues and information, Stocker Concrete Material Washer Company, Care of Cement & Engineering News, 1117 Schiller Bldg., Chicago.

ILLUSTRATIONS OF THE NEW NORTHWESTERN RAILROAD DEPOT IN CHICAGO.
IN ITS CONSTRUCTION PORTLAND CEMENT WAS USED TO A
PREDOMINATING EXTENT.



CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year,
or two years for \$1.50, 3 years for \$2.00. All other countries,
\$1.50 per year.

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month.

Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, APRIL, 1914

GEORGE WESTINGHOUSE

On the twelfth of March died, at his New York residence, George Westinghouse, a man who was unanimously considered by the engineering societies of the world the greatest American engineer of the present time.

Heart failure set an end to this brilliant career, which was characterized up to the last by wonderful mental alertness and vitality.

The sixty-eight years of the life of this remarkable man were so prolific in inventions that they would have sufficed to make a dozen men famous. Whatever branch of engineering he decided to take up was greatly benefited in the course of time and enriched by theoretical and practical improvements. Thus, one by one, his genius added invaluable information and useful mechanical devices to railroad engineering, electric power transmission, to the uses of natural gas, to the various branches of the heating and lighting industries and to the practical application of the steam turbine.

The name George Westinghouse, therefore, is intimately linked with all progress made by the engineering world of the present era, which has so profusely contributed to the comfort of our time and has made this an age of industrial enterprise. The outcome of his endeavors and result of his numerous inventions was invariably the formation of large manufacturing companies which carried out his plans and transformed his thoughts into a series of commercial successes of the first magnitude, so that we may say no inventor has ever been more liberally and more justly rewarded for his work than George Westinghouse. The various

Air Brake and Electric Light and Power Transmission companies in different parts of the world carrying the name "Westinghouse" are a vivid illustration of the marvelous results accomplished by the inventor. These, however, are only a few of the companies to which his genius gave birth and over which he presided. The Union Switch & Signal Co., the Westinghouse Friction Draft Gear Co. and the Westinghouse Metal Filament Lamp Co. may be mentioned as the most important among the companies less widely known. For the benefit of those who are able to measure achievements only by figures we may add that this captain of industry employed in his various plants fifty thousand men, and that the capitalization of the combined Westinghouse companies amounts to two hundred million dollars.

A brief enumeration of the principal events in the life of George Westinghouse may be of interest to the reader:

George Westinghouse was born at Central Bridge, Schenectady County, N. Y., on the 6th of October, 1846. His parents were George and Emeline Vedder Westinghouse. The father's ancestors came from Germany and settled in Massachusetts and Vermont before the Revolution; the mother's were Dutch-English. Westinghouse's father was an inventor, who, in 1856, removed his family to Schenectady, N. Y., where he established the Schenectady Agricultural Works.

The boy attended the public and high schools of the town, spending much of his leisure time, after studies, in his father's machine shop. What to other lads would have been regarded as irksome and confining, young Westinghouse found to be a source of amusement and instruction.

Before he was fifteen he invented and made a rotary engine, and passed at an early age the examination for the position of Assistant Engineer in the United States Navy.

After the Civil War he spent a short time at college and then entered upon active life to find a wider scope for his inventive genius.

In 1865 he invented a device for replacing railroad cars upon the tracks, which, being of cast steel, was manufactured by the Bessemer Steel Works, at Troy, New York.

Going to Troy one day, a delay caused by a collision between two freight trains, suggested to young Westinghouse the idea that a brake under the control of an engineer might have prevented the accident. His first thought was an automatic brake attached to the couplers, which was unsuccessful. This was followed by steam, which proved also to be unsatisfactory, because by the time it reached the brake from the engineer's cab it lost its power.

At this point Fate seems to have entered his life. In the pages of a magazine he had subscribed to, he saw an account of the use of compressed air in digging the Mont Cenis Tunnel, three thousand feet underground. Instantly the inventor saw the light.

The inventor began to think over the matter, and, after much further study and investigation, the use of compressed air further impressed itself on him. Drawings of the air-pumps, brake cylinder and valves were made, but considerable time elapsed before a practical trial of the brake was obtained. The first patent was issued April 13, 1869, and the Westinghouse Air Brake Company was formed on the 20th of July following.

Many changes and improvements were being made in the brake all the while, the business flourished, and the manufacturing works, begun in 1869, were completed in 1870. In 1870 Westinghouse went abroad

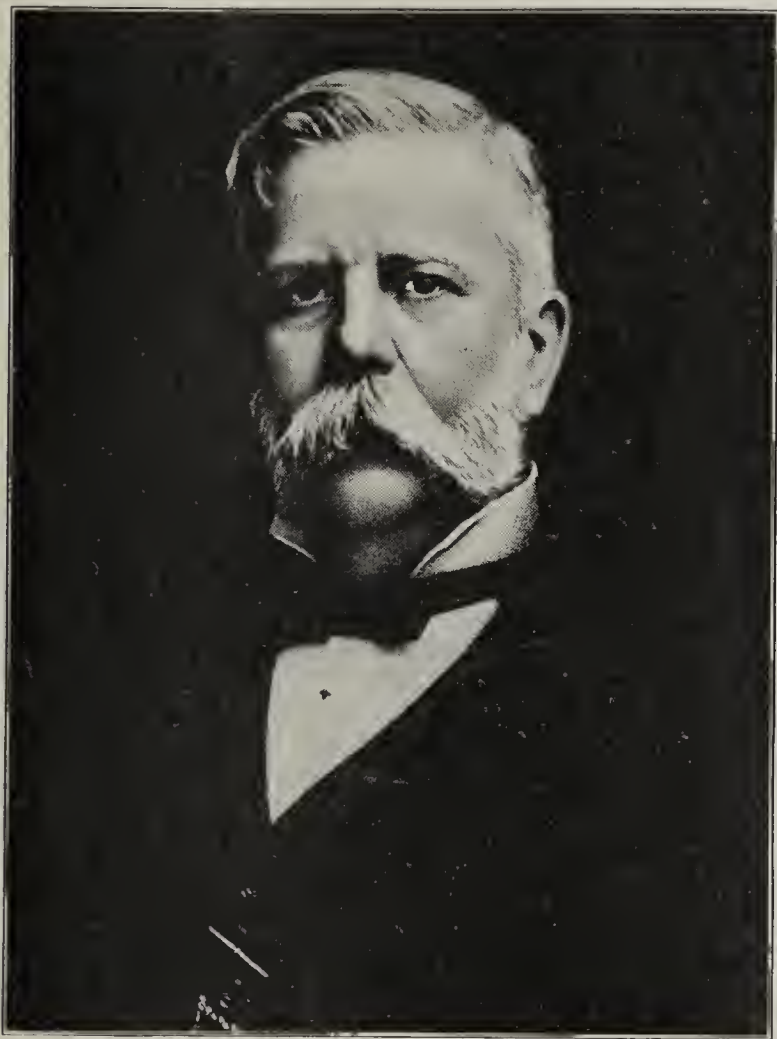
to introduce the air brake in England—a difficult problem, as the trains in Europe had hand brakes upon only what were known as “brake-vans,” there being no brakes upon the other vehicles. Not only did this require spending of seven years in Europe, between the years 1871 and 1882, but it taxed his inventive ability considerably to meet the new conditions of railroad practice.

In the meantime, Westinghouse invented the “automatic” feature of the brake, which overcame the imperfections in the first form, and removed the danger from the parting of trains on steep grades. In 1886, he invented the “quick-action” brake, the improvement being made in what is known as the “triple-valve.” By this valve it became practicable to apply all brakes on the train of fifty freight cars in two seconds. The

ted States Electric Company and the Consolidated Electric Light Company. In 1891 all these properties were reorganized into the Westinghouse Electric & Manufacturing Company, which owns extensive works at East Pittsburgh, employing over 22,000 people.

In 1892, Westinghouse secured for the Electric Company the contract for the electrical equipment of the World's Fair at Chicago, and in 1893 the contract for the large generators at Niagara Falls, both of which marked epochs in the progress of the electrical industry.

In 1895, the Electric Company outgrew the small quarters at Garrison Alley and moved to East Pittsburgh, and the same year works of the British Westinghouse Company were established at Manchester, England.



George Westinghouse.

automatic and quick-action brakes are regarded by experts as surpassing the original brake in ingenuity and inventive genius, being not mere improvements, but distinct inventions of the highest class, unique and remarkable.

About 1880, Westinghouse became interested in the operation of railway signals and switches by compressed air, and soon after there was developed and patented the system now manufactured by The Union Switch & Signal Company. The “Pneumatic Interlocking Switch and Signal Apparatus,” whereby all the signals and switches are operated from a given point, using compressed air as the motive power. Electricity to bring that power into operation has been successfully introduced in Boston, Jersey City, Philadelphia, Chicago, St. Louis, and many other places.

In 1886 the Westinghouse Electric Company was formed for the manufacture of lamps and electric lighting apparatus, Westinghouse having become interested in the subject. The business rapidly developed and in 1889 and 1890 this company absorbed the Uni-

Subsequently, the question of the steam turbine and its application was investigated by Westinghouse. He secured the patent rights of Charles A. Parsons, of England, on the turbine in 1897-98. This development of a new prime mover soon led the inventor to consider the use of the turbine as a prime mover for ships. The trouble was the high speed. Westinghouse then developed and brought out one of the most ingenious inventions of modern mechanical engineering. This was the mechanical reduction gear for reducing the inherently high speed of a turbine to the slow speed of a ship propeller or direct current dynamo. This device is destined to revolutionize marine construction.

He accomplished this work in collaboration with the late Admiral George W. Melville, U. S. N., and John H. MacAlpine. Within the last few years he also occupied himself with the development of an air spring for automobiles and motor trucks, which rapidly came into favor.

Westinghouse rendered an invaluable service to the

electrical development of the world, when, in spite of opposition, ridicule and all the unfair efforts to crush his alternating current system, he remained steadfast in his belief that this class of high tension transmission would make distant electrical distribution possible. This system his engineers developed, and incidentally in this connection secured the services of Nicola Tesla, 1887, who invented the alternating-current induction motor. The world today lighted by distant waterfalls and central stations, now recognizes its debt to Westinghouse's foresight and perseverance.

A struggle almost identical with that of the earlier fight for alternating-current transmission is the recent development of alternating-current traction by means of the single-phase motor, which the Westinghouse Electric & Manufacturing Company has now wrought into an accomplished reality in the case of a number of traction lines, railroad terminals and tunnels. In spite of the same bitter competition, refined in its subtlety only by the advance of the years, Westinghouse achieved a far step in electric railway practice which the electrical world was quick to follow, just as in the case of alternating-current transmission.

The value of natural gas to the manufacturing industries of Pittsburgh was first foreseen by George Westinghouse, who organized a company to develop this vast resource of Western Pennsylvania, and who met in characteristic fashion the engineering problems involved.

Originating with one of the most important inventions connected with railways, the growth of the various Westinghouse industries has been largely identified with railway progress, and it is interesting to note that this progress has represented increased security of life, increased capacity of the railway and reduced cost of operation. It is simply stating a fact to say that Westinghouse has been a great factor in the advance of civilization as represented by the important part he has played by introducing improved means of transportation.

Chance has had no place in the success of this man. It has been due to his foresight, courage and technical skill. As with his first invention, the air brake, the different kinds of apparatus had been developed to answer actual needs, in some cases acknowledged generally, and in others foreseen by him with remarkable prevision. When the apparatus had passed the experimental state and was ready for commercial exploitation, he established factories which were themselves models, and which showed the same anticipation of future development. Not only are the buildings handsome and well equipped with the best tools, but the comfort of the employees has been considered in every respect. It is worth noting that the nine-hour day, or rather the fifty-four hour week, was started in the Air Brake Works in 1869, and has been adopted in all the other works as they have been established.

Owing to his many achievements in mechanics, electricity, steam and gas, his name was known the world over, and he had many honorable distinctions conferred upon him for his achievements and in recognition of the services he rendered the various branches of engineering.

Although actively associated with a large number of industries, he had during the last few years begun to transfer his responsibilities to the shoulders of his trusted lieutenants, the fortunate selection of which has always been one of the leading characteristics of his varied career.

His demise, therefore, will not cause any material change in the policy or operation of the companies so indelibly linked with the name Westinghouse.

LUTEN PATENTS AND LITIGATION

Under the above title Daniel B. Luten, of Indianapolis, has issued an interesting booklet which plainly sets forth the policy which controls the issuance of licenses to build Luten Design Bridges and which actuates him in the prosecution of suits against infringers. Mr. Luten discusses in a very thorough manner the thirty-six bridge patents which have been issued to him, and states that it has been his policy not to combine patents issued to others nor have infringers been prosecuted unless they have opposed Luten design for the particular bridge.

There has been much talk of western states combining to fight the Luten design patents, and an apparent effort on the part of newspapers to put Mr. Luten into a class with certain notorious patent monopolists, thereby arousing public sentiment against him and his designs. County officials throughout the country and all bridge contractors should read the last Luten booklet carefully and become thoroughly informed concerning Luten patents and Luten methods. When an engineer has done so much for the cause of permanent and slightly bridge construction it is unwise to judge him by colored newspaper reports. The Luten policy has enabled many contractors to do concrete bridge work they could not have secured otherwise and no patent owner has ever been fairer or less monopolistic. The facts in this case are fully available to all, and all interested parties should familiarize themselves with the record.

HYDRATE LIME

In your March Edition, I notice you have an Article on Hydrate Lime, and wish to state that whoever wrote this article, as well as the Editor, who passed on same, is not, it seems to us, well informed on matters pertaining to Hydrate Lime, writes A. H. Lauman, president and manager, National Mortar & Supply Company, Pittsburg, Pa., who have a large lime hydrating plant at Gibsonburg, Ohio.

The point about Gypsum Plaster is well taken, however, the point with regard to Magnesia in Hydrate Lime is altogether against the United States Government Standard as reported in one of their publications from the Bureau of Standards. In which they state that Magnesia Hydrate Lime is stronger than high Calcium Hydrate Lime. High Calcium Lime is stronger the first week, but within three months they are even in strength, and within six months Magnesia Lime is leading in strength. Please correct same in your next issue, as the writer has been an observer of things, ever since Cement and Engineering News made its first appearance.

MEDUSA WATERPROOFING PATENT SUSTAINED

In the United States District Court, Northern District of Illinois, on Feb. 13, 1914, a decree was entered declaring the Newberry patent No. 851247 to be good and valid, and that the McCormick Waterproof Portland Cement Co. and S. T. Sjoberg infringed said patent and are perpetually enjoined from making or selling waterproof cement or carrying on the process described in said patent, and that the complainant shall recover the damages resulting from said infringement.

Suits against other infringers have been begun and will be vigorously prosecuted.

The World's Largest Stone-Crushing Plant

With railroad lines springing into existence in every corner of the globe, with mammoth manufacturing plants being constructed to fabricate iron products, with great skyscrapers climbing to dizzy heights and with huge steel vessels and warships being constructed by all nations, a tremendous impetus has been given to the production of iron and steel. Some of the richest of the iron ore deposits are located on the shores of the Great Lakes, and naturally steel plants of great capacity have been built there at points within easy reach of the mines and yet advantageously located commercially. There occurs also, in this same locality, the largest known deposit of high-grade limestone, thus providing an abundance of material for use as flux in the blast furnaces, 5,000,000 tons of it being required annually for the blast furnaces on the Great Lakes.

This deposit of limestone is located at Calcite, in Presque Isle County, in the northeastern portion of the southern peninsula of Michigan, and is owned by the

Small steam locomotives haul these cars, in trains of seven, to the crusher house, where the stone is dumped into a 42-inch gyratory crusher, the largest of its type in the world. To dump the cars, their bodies are tilted sidewise by a small winch whose steel hoisting cable passes over a pulley on a swinging structural-iron beam located above the track. This winch is driven by a 10-horsepower, 220-volt, alternating-current, back-gear induction motor of the wound-rotor type, the power for its operation being stepped down from a potential of 2,300 volts by two 7.5-kilowatt transformers.

Approximately one minute is consumed in dumping each car and, as soon as the seven are unloaded, the train passes on around the loop, back to the quarry to take the place of a train loaded while it was being unloaded. Train loads of rock are sent from both ends of the quarry so as to make the delivery of stone to the crusher as continuous as possible.



Fig. 1.—Power Station and Pier with Conveying and Loading System. Michigan Limestone & Chemical Co., Rogers City, Mich. Eleven "Clipper" Blast Hole Drills, Manufactured by The Loomis Machine Company, Tiffin, O., Are Used in Their Quarry.

Michigan Limestone & Chemical Company. The rock-crushing plant is electrically driven throughout and illustrates very forcibly the great advantages of the electric drive as compared with other forms of drive in this industry.

The limestone formation at Calcite runs nearly parallel to, and at a short distance from, the lake shore, and the part now being worked is a bluff approximately 40 feet in thickness, the crest having an average elevation of about 70 feet above the lake level. From the bottom of the bluff, the ground slopes in a series of irregular terraces for a distance varying from 500 to 700 feet to the shore line. A track, which can be moved laterally as the work progresses, runs along the base of the bluff and connects the quarry with the crusher house by means of a trestle-supported loop.

In the quarry eleven "Clipper" blast hole drills, manufactured by the Loomis Machine Company, Tiffin, Ohio, are used with great success and the company is well pleased with them. The rock, after being loosened by blasting (Du Pont Dynamite used), is loaded into 12-ton cars by two 100-ton Marion steam shovels and two 90-ton steam shovels.

Motor Drive

For driving the crushers, screens, and belt conveyors the slip-ring type of induction motor with wound-rotor and external resistance in the rotor circuit is used. In starting, these machines give 150 per cent of full-load torque with approximately 150 per cent of full-load current and so will start up the plant with the crushers, screens, and conveyors partially or fully loaded without overloading the power station. With three exceptions, 2,300-volt three-phase motors are used throughout, the power being transmitted at this potential for their operation.

The advantage of the electric drive is strongly brought out in connection with the conveyor system. Here 18 motors, aggregating 1,280 horsepower, drive 12 belt conveyors, covering a total distance between centers of end pulleys of more than 2,100 feet. As the various sections of the conveyor system are interdependent, simply passing on what is delivered to them, their operation must be nearly synchronous to be most efficient. This is accomplished with a minimum power consumption by employing individual polyphase induction motors to drive the various sections at a

standard speed of 400 feet per second, with the exception of two auxiliary belts in the recrushing section, and by driving through gears or relatively short belts.

Crushers

The crusher, which, as stated above, is the largest of its kind in the world, has a weight of a half million pounds. It is belt-driven by a 200-horsepower, 2,300-volt, induction motor of the slip-ring type. The aver-

age load carried by this motor is 60 horsepower but it varies with the amount and the size of the rock delivered to the crusher, reaching a maximum of 265 horsepower as the heaviest load under normal working conditions. Yet the overload capacity of this motor is so liberal that the crusher has been started from a standstill when it was full, throwing a load of 450 horse-

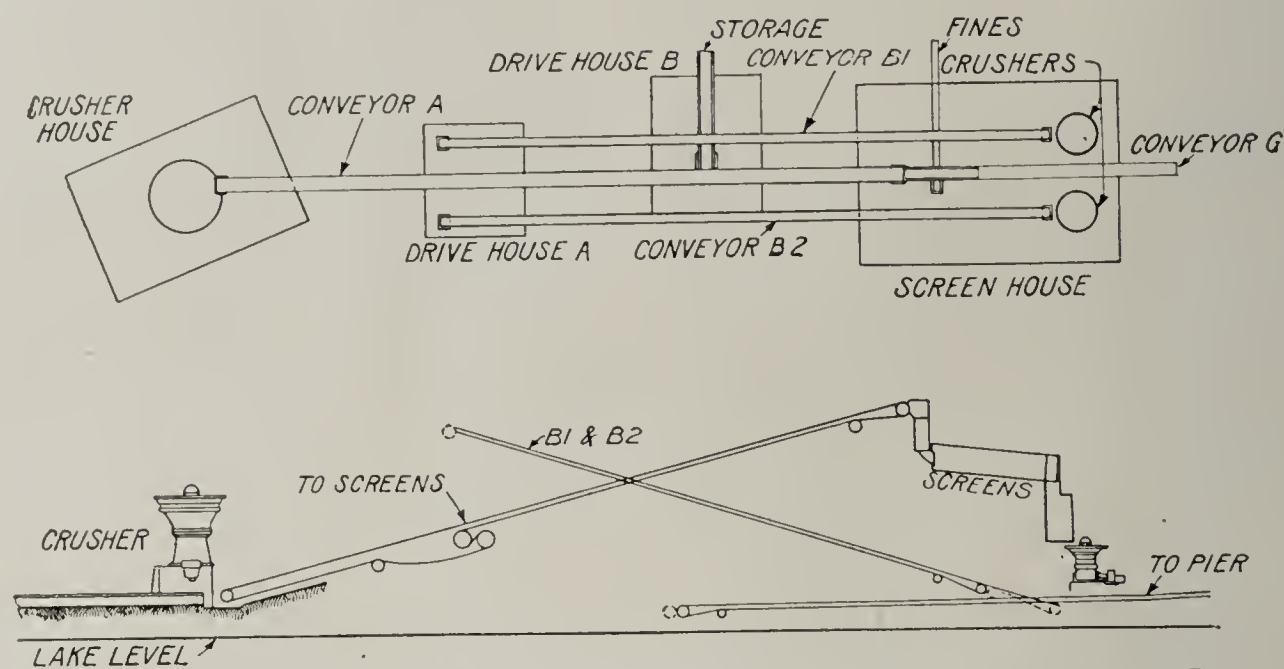


Fig. 2.—Plan and Elevation Showing Positions of Crushers, Screens and Conveyors. Michigan Limestone & Chemical Co.

age load carried by this motor is 60 horsepower but it varies with the amount and the size of the rock delivered to the crusher, reaching a maximum of 265 horsepower as the heaviest load under normal working conditions. Yet the overload capacity of this motor is so liberal that the crusher has been started from a standstill when it was full, throwing a load of 450 horse-

power driven by a 125-horsepower induction motor, back-gearred to the driving pulley of the conveyor.

Screens

Rotary screens, the largest units of this type in operation, each consisting of a cylinder seven feet in

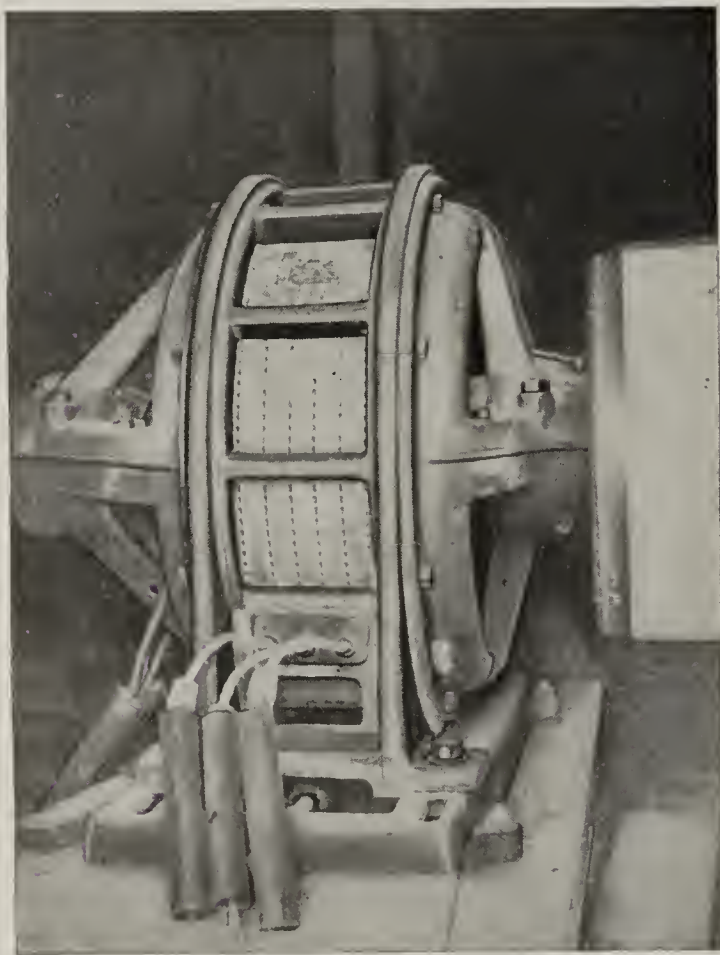


Fig. 3.—Induction Motor Driving Main Crusher; 200 h. p.

power on the motor momentarily, and this load has been safely carried. This motor is not provided with an outboard bearing, yet it has withstood this service since it was first installed.

Conveyors to Screens

From the base of the crusher, the rock is discharged

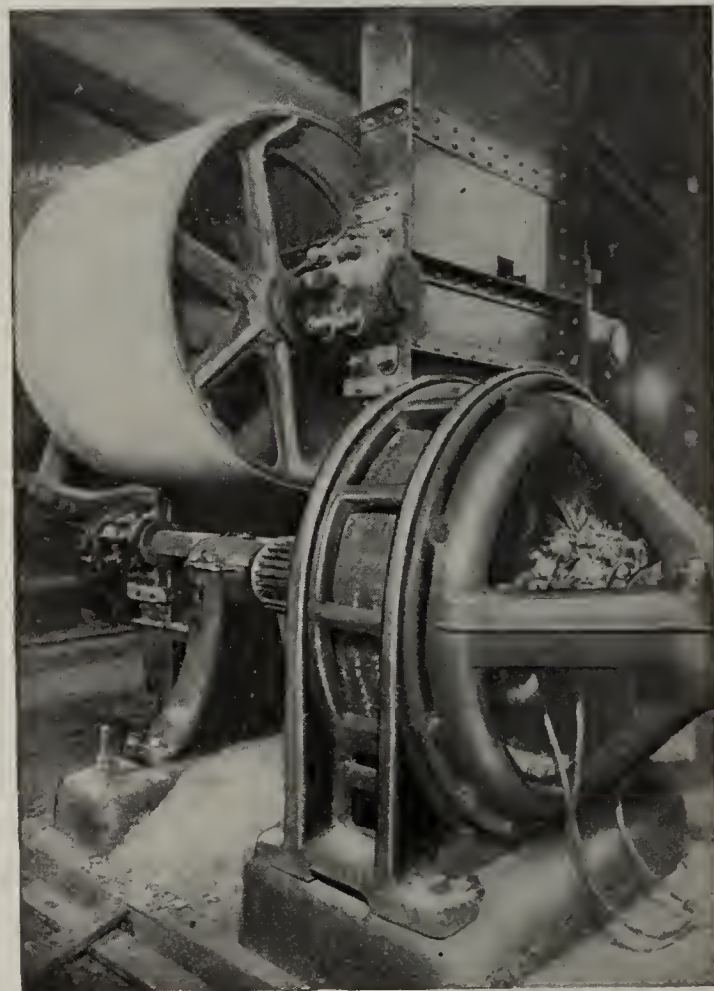


Fig. 4.—Induction Motor Driving Reclaiming Conveyor; 125 h. p.

diameter and 32 feet long, in which there are graduated perforations, assort the crushed rock. These screens are individually driven by 50-horsepower motors which rotate the screens by means of a belt-driven jack-shaft, the latter operating through direct-connected bevel gearing.

These screens separate the rock into three classes. The "fines" i. e., material which passes through holes less than one inch in diameter—is unfit for flux and so is discharged into a hopper below the screens, from which it passes to a belt conveyor, which runs at right angles to the main conveyor line and carries it to a "fines" bin, from which it is loaded into cars and util-

From the lower ends of the screens the "oversizes" are fed directly to two small gyratory crushers which are individually driven by 75-horsepower belt-connected motors. From the crushers the rock is elevated by two 30-inch belts. (B1 and B2, Fig. 2), each having a capacity of 250 tons per hour, to a chute which delivers it again to the conveyor (A, Fig. 2)



Fig. 5.—Shuttle Conveyor Delivering Stone to Ship's Hold.

ized for filling. This cross conveyor has a 24-inch belt, a length of 140 feet between centers of the end pulleys, a capacity of 250 tons per hour, and is belt driven by a 20-horse-power motor, the load varying with the character of the rock passing through the screens, but not normally exceeding eighty per cent of the rated capacity of the motor.

The rock which passes through the perforations in

to the screen house, where it again passes through the screens. The belts B1 and B2 are each driven at a speed of 200 feet per minute by a 20-horsepower belt-connected motor. These conveyors will be discarded shortly, as, by altering the small crushers their output can be delivered directly either to the conveyors running to the loading dock, or to those going to the pile of stone stored for future shipment.

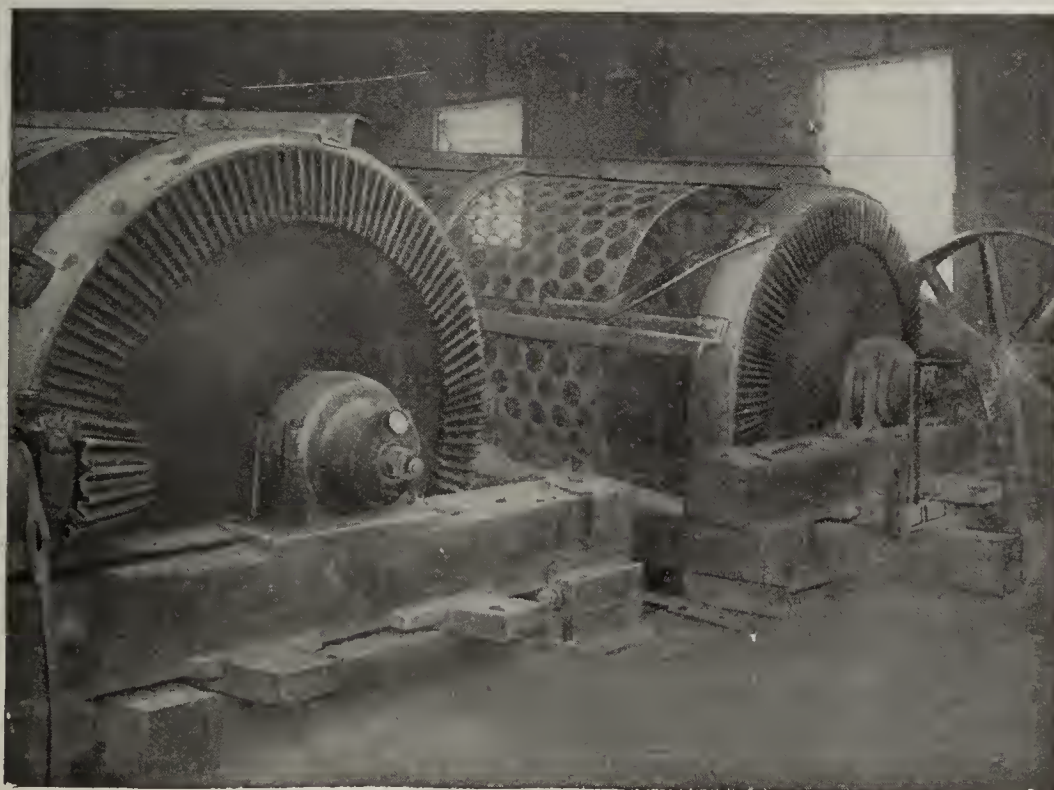


Fig. 6.—Sorting Screens, Each Driven by 50 h. p., 2,300 Volt Induction Motor.

the second section of the screens varies in size from a minimum of one inch to a maximum of six inches in diameter and is a suitable "flux stone." It is discharged into a bin, from which it is either spouted onto the main conveyor, which carries it out to the pier, or else is delivered to the belts serving the stone storage pile.

Belt-Conveyor System from Screen House to Pier

The conveyor system for carrying the "flux stone" from the screen house to the loading bin on the pier is divided into three sections, each section being provided with a 44-inch belt having a capacity of 1,300 tons per hour, the lengths between centers of the end

pulleys being 360, 140 and 130 feet. Individual motor drive is employed, two of the motors, of 125-horsepower capacity, being geared to the driving pulleys, while the third, a 35-horsepower unit, is belt-connected.

In passing over the conveyors along the pier, the "flux stone" is elevated 54 feet and discharged into a loading bin of 500 tons capacity located near the outer end of the pier.



Fig. 7.—Motor-Driven Car Dumping Hoist.

Method of Loading Ships.

From the loading bin, the "flux stone" drops through a hand-operated gate onto the belt of a shuttle conveyor, which operates at right angles to the conveyor from the screens to the storage bin on the pier. This shuttle conveyor consists of a structural-steel framework carrying an endless belt 48 inches in width. The framework is mounted on stationary wheels so that it can be moved forward or backward to compensate for varying sizes of hatchways in the different vessels and to make the adjustments necessary for depositing the stone evenly in the hold. This movement is accomplished by means of a drum provided with a steel cable, the ends of the latter being connected to the opposite ends of the movable conveyor framework. The drum is driven by a 20-horsepower, 220-volt induction motor of the squirrel-cage type, installed on a platform just below the conveyor. The belt is driven by a motor of the same type and capacity. The conveyor delivers the stone at an average rate of 1,000 tons per hour, but its maximum capacity is 1,400 tons per hour.

The control of the motors and bin gate is centered in an operator's house located above the conveyor (see Fig. 5) where the operator has a clear view of everything concerned in loading. As the service requires a comparatively low starting torque, the squirrel-cage type of induction motor was selected, current being supplied to the motors from the 2,300 volt feeder line by two 10-kilowatt transformers which step the potential down to 220 volts.

At present, it takes about six hours to load a 6,000-ton ship, it being necessary to wharf the ship along the pier as the successive hold compartments are filled. Upon the completion of the construction work at Calcite there will be seven additional loading bins, each provided with a shuttle conveyor, and then a 6,000-ton ship can be loaded in approximately two hours.

Delivery to Storage Pile and Reclamation

It is obvious that the loading of the ships cannot be made a continuous process, as some time must elapse while a loaded ship is clearing the harbor and an unloaded one is being brought alongside the pier. At the same time it is essential that the operation of the

crushing and conveying system be maintained without interruption if the maximum efficiency of the plant is to be realized. To render this possible, storage facilities, having a recoverable capacity of 13,000 tons, have been provided.

When the "flux stone" is to be delivered to the storage pile, it is carried by a short belt, 68 feet in length between the centers of end pulleys, to drive-house B (Fig. 2), where it is deposited on a cross conveyor, which elevates it at an angle of 15 degrees and delivers it to a conveyor running out over the storage pile at an elevation of 65 feet above the lake level. All three belts are 40 inches wide and have a capacity of 1,000 tons per hour. The short transfer belt is driven by a 35-horsepower, belt-connected motor, while the elevating and delivering belts are driven by a 150-horsepower motor located in a tower at the head of the storage pile and gear-connected to the two driving pulleys where the two belt conveyors come together.

The belt conveyor which delivers the "flux stone" to the storage pile is 190 feet in length between centers of the end pulleys and is installed on a structural-steel bridge with A-frame supports mounted on concrete foundations, the design being such that the running stone does not strike the steel work. A tripping device, operating along the belt, insures an even distribution of material on the storage pile.

A concrete tunnel, which extends under the bridge and parallel to it, is provided with a row of gates in each side near the top. When it is desired to get stone from the storage pile, some of the gates are opened allowing the stone to pass through, where it is deposited onto a 44-inch reclaiming belt, 360 feet long between centers of end pulleys, which runs level in the base of the tunnel. This conveyor carries the stone to the drive house B, where it is discharged onto



Fig. 8.—Induction Motor Driving Conveyor Belt from Screen House to Pier.

the main conveyor line and delivered to the loading bin on the pier. The reclaiming belt is gear-driven by a 125-horsepower motor and has the same capacity as the main conveyor line, or 1,300 tons per hour.

When the stone is being delivered to the storage pile, the reclaiming conveyor and the pier conveyor line are not in service, and the storage pile is drawn on when the crushing and screening machinery is not in operation; but when the rock is passing directly from the main crusher to the loading bin, none of the

motors on the storage system are used. For this reason, the 750-kilowatt turbo-alternator can at all times supply sufficient current for the operation of the plant, although the aggregate rated capacity of the motors on the feeder circuits is greatly in excess of the power station's output.

MOTOR EQUIPMENT.

No.	Horse-power.	Revolutions per Minute.	Drive.	Service.
1	10	...	gear	Dumping hoist.
1	200	600	belt	Large crusher.
1	125	600	gear	Conveyor to screens.
2	50	900	belt	Screens.
1	20	900	belt	Conveyor to dump.
2	75	600	belt	Small crushers.
2	20	900	belt	Oversize conveyors.
1	125	600	gear	G conveyors to H on pier.
1	125	600	gear	H conveyor to H1 on pier.
1	35	900	belt	H1 conveyor to loading bin.
1	20	720	gear	Shuttle conveyor.
1	20	720	gear	Shuttle adjuster.
1	35	900	belt	D1 conveyor to D.
1	150	600	gear	Conveyors to storage.
1	125	600	gear	Tunnel conveyor.

The control equipment for the motors includes controllers, oil switches, and time-limit relays to take care of individual overloads, but no circuit-breakers or fuses are used, as the safety of the equipment is assured by a simple but very reliable emergency system, which controls the motors in two groups and cuts out of service all the units in either group in case a motor is stopped. Each of the two groups of motors is supplied by a separate feeder, one of these supplying the motors on the shore, including those connected with the storage system, while the other supplies the motors on the pier and shuttle conveyor. By means of snap switches located at various points in the plant, or carbon contacts on the motor panels connected across two independent direct-current circuits, the latter being supplied by the direct-current turbogenerator in the power station and therefore uninfluenced by the alternating-current power circuit, the trip coils on the oil switches of either of the feeder circuits may be operated, thereby stopping the motors throughout the section. Thus congestion of material at any one point, due to the shutdown of a motor is prevented. Red



Fig. 9.—Storage Pile, Bridge Carrying Delivery Belt and Concrete Tunnel which Houses Reclaiming Belt Conveyor. Two Marion Steam Shovels Are Used by This Company.

CONVEYOR SYSTEM.

Belts.	Capacity in Tons per Hour.	Width in Inches.	Centers in Feet.	Grade in Degrees.	Speed in Feet per Minute.
A	1450	40	182	15	400
B1&2	250	30	163	17	200
C	250	24	140	17	400
D1	1000	40	68	17	400
D	1000	40	167	15	400
E	1000	40	190	level	400
F	1300	44	360	level	400
G	1300	44	360	20	400
H	1300	44	140	17	400
H1	1300	44	130	level	400
J	1400	48	70	level	400

A—Conveyor from crushers to screen house.
 B1-B2—Conveyors from small gyratory crushers to chute to screen house.
 C—Conveyor for "fines."
 D1, D and E—Conveyor system from screen house to storage pile.
 F—Reclaiming belt in tunnel.
 G, H and H1—Conveyor system from screen house to loading bin on pier.
 J—Shuttle conveyor.

The conditions under which the motors operate vary with their location. Some are mounted on substantial concrete foundations, while others are installed on wooden beams. All are of the open-frame type, and, with a few exceptions, are not housed in, yet they operate sometimes 24 hours per day, in an atmosphere carrying considerable limestone dust. The motors have dust-proof bearings, and are blown out each day with the air blast, so no injury has resulted from the dust. It is planned to provide dust-proof housings with air ducts in top and bottom, thus giving a natural ventilation.

lamps, connected across the emergency circuits, remain lighted as long as the power circuits are alive.

As the power is transmitted but a comparatively short distance, the maximum transmission distance being about 1,300 feet, practically no allowance need be made for voltage drop, and so no transformers, except those used with the three 220-volt motors, are required.

Varnished-paper-insulated stranded cable is used, and, except for the tunnel and pier circuits, all conductors inside the buildings are run in iron conduit.

For lighting, both carbon and tungsten incandescent lamps operate on 125-volt circuits, fed from the exciter busses. Ultimately a series incandescent system provided with Mazda lamps will be installed for the illumination of all buildings, yards, roads and steam shovels.

Power House

The power house is located on the lake shore, about 200 feet south of the pier. The generating units consist of a 750-kilowatt, 2,300-volt, three-phase horizontal Curtis turbogenerator operating at 3,600 revolutions per minute, and a frequency of 60 cycles, and operating condensing at a steam pressure of 150 pounds; a 25-kilowatt, 125-volt direct-current Curtis unit, operating noncondensing and furnishing excitation current for the 750-kilowatt turbine, and also supplying power to the lighting and emergency cutout circuits. There is the usual switchboard in the power house, but at the present time hand regulation is employed. The entire plant is operated 20 hours per day under normal conditions, but the power station is in service continuously. It started up in June, 1912, and

since then only one shutdown due to the electrical system has occurred. This was caused by a drop in potential which cannot be justly charged to the electric system as it resulted from the hand method of control which will be superseded at an early date.

Facilities for Shipping.

Since starting, shipments of limestone for blast-furnace flux have been sent by water to Buffalo and Chicago, and under normal weather conditions this service can be continued during seven or eight months of the year. The facilities at Calcite include a slip 1,100 feet long and 90 feet wide with a depth of water at the pier of 21 feet, sufficient for the largest vessels on the Lakes. A stone breakwater, 1,200 feet in length and 80 feet in width, ensures a safe harbor for the ships while loading.

As regards the electrical operation of the plant, it may be said that the effective centralization of the power plant, the good overall efficiency of operation, the simplicity and safety of the power-supply system, and the coordinate operation of all sections of the plant equipment which has been attained at Calcite would have been impossible with any other system of operation.

The Michigan Limestone & Chemical Company assigned the design and installation of the power plant to J. G. White & Company, of New York, the conveying system being provided by the Robins Conveying Belt Company, and the electrical apparatus, and steam turbines by the General Electric Company.

SALES PROMOTION AND ORGANIZATION WORK

By Herbert N. Casson*

I was given to understand that this convention was not going to be one of the ordinary sort; I was given to understand that you needed to start something or quit. They told me that here is a chance to get something going. Here you are confronting your trade for 1914 and we know there is a good year coming. We have never had enough in the past to brag of, and we are noticing these things now. The pessimists said the tariff bill was going to wreck us, and the currency bill was fought against until it was passed, but now these important measures behind us we find everybody only too eager to fall in with the same.

Here you have an old trade.

I was talking to the salesmen of the Burroughs Adding Machine Co., which is a brand new business. Those men are alert and making money. It is different with you. In every old business there is a danger. When we are thrown upon our own resources we learn our business; we pick it up. Here you are in an old trade in the midst of new things and what are you going to do? There are so many new things coming into vogue, and so many new methods of doing business, that if you do not keep up with the times you will lose out.

There are 8,000 dealers in the country in your line of business, and yet you have only a small number enrolled as members of this association, and you only ask \$10 a year. You are not in the game at all. You are scarcely even looking on; and the problem is whether you are going to be in this game. They all talk about cutting out the middleman. There will always be the middleman. You have got to have him; the only question is whether it is going to be you who will get the profit or the manufacturer's agent. We are finding out a lot about this talk about selling

direct. Cutting out the dealer and buying direct from the manufacturer is not a good thing.

You have got to organize. Some men think they are in business; they are not, they are only in trouble. You are doing a lot of business, but making nothing out of it. The lightning bug has a headlight at the back but no mind; you have minds but no headlight at the back. You have got to get out and learn this new gospel of efficiency. If you turn your back on efficiency your competitor gets hold of it. There is a difference between net and nit; last year it was nit. All sorts of expenses are piling up and the money we get back does not. The new thing is not to go after gross business, but find out how to work up new trade and make money out of it. Many jobbers are keeping in business by simply handling one specialty. You should demand a profit on every deal. If you take any business that does not make a profit, you will be taking more next year on the same terms.

Price-cutting is not business; business means making a profit. You have to reach out for a wider market. There is nothing so cheap as money, and nothing as dear as labor. I would suggest pinning medals on architects and dining contractors. The contractor costs more, because you have to feed him. The suggestions I have given you I have tried out within the last eleven years. You can get close to the architects by giving them some glory, but a contractor wants the money.

It may be a good thing to get a salesman as a partner. Very few men who know how to sell can buy and vice versa. A buyer and a seller together can make four times as much as they can alone, because it takes that kind of a thing to make a good business. Conditions now are against you; the people you have to deal with on both sides are better organized than you are, and you are waging your fight with bow and arrow against modern artillery. How can you change conditions; how can you raise prices? How can you get together and lift your trade up? You can create demand, you can develop a sales policy; there is no reason why you should not have trained salesmen. Most of you have the old kind of salesmen, who when they feel well can go and sell goods; and when they don't feel well they won't go out.

We all think we are born with the letter "S" on our shoulders; we think we are born salesmen. We are finding out that you can train your salesmen and hold your salesmen down to it. We are getting away from that kind of thing of selling people what they want. The question is whether you are dealers or janitors of a pile of truck. You can handle men as you can handle cement and other products. Men are all of the same breed, salesmen know that. I know men are alike, there is no difference in men. There are just two handles to all men—pride and profit.

We are finding out there is an art in salesmanship. The way to sell goods used to be to talk a man to death—that was the wrong way. We listen today. A man is like a barrel; you have got to empty him before filling him. When you want to handle a man the first thing to do is to get him good-humored. Get him to talking about himself—listen a man into the thing. The way to talk to a man—the way to sell goods, is to get the man so interested that he will not know whether you are talking or he is thinking. No man deals with a stranger; friendship rules this world—not money. You have to be interested in his business; get around on the same side of the table as the man you are talking to. We are finding out that there is an art in handling men as well as in salesmanship.

*Address made before the Fifteenth Annual Convention of the National Builders' Supply Association, held in Chicago, February 18 to 21, 1914.

There is no reason why you can not use advertising in your business—it is the biggest power there is.

Mr. Casson cited a case of the method used to advertise and sell lawn mowers, and said there is no reason why you cannot in your business use this method of advertising—it is the biggest power there is. Some of you men who think you can't sell lime or cement by advertising, advertise for a cat under your own name and see how many cats you will receive. That is the power of advertising—most marvelous power. There is nothing you cannot do by advertising—there is nothing you cannot make interesting by it. You get an idea that advertising is an expense, but it is not; advertising brings in; it does not take out. Advertising does not spend; it saves. An advertising man is a saver built like a spender, but an advertising man is not a spender.

Unless you fight for a price the public will never give you one. The public never appreciates anything you give it; it does not care for price, the public gives you whatever price you make it give you. Nobody cares about price; all sorts of prices are paid for various commodities. It is not the thing you can do, it is the story of it. There is no limit to price. You are heading in the wrong way by price-cutting. Make up your minds that you are going to get a reasonable price, and you can get it. Put your stuff up and see that you get the price. Get a jingle on your name, by adopting some sort of a slogan for your goods. Why should not your business be interesting? Why cannot you make it interesting?

There is no reason whatever why you cannot do these things; you can entirely change your methods if you so decree. I will give you this motto: "The Future Has No Paths." There is no reason why you should not be making money; if you only have the nerve enough to demand a reasonable price for your product; you have the goods, but you have never had the nerve. Put out a dollar and you will bring in ten. You are in a fight to protect your own business in your own city. You have got to know where the demand is and bring the business to you instead of waiting until it comes to you. Hang on to the association and the city that belongs to you. There is no such word as impossible.

They are working wonders in nearly every other line of business; why should you be a tail-end trade? Why should you not run your business profitably the same way as Burroughs and others. Here is another good motto for you to keep in mind, "Bite off more than you can chew; and chew it." Cannot you fellows help boost the association by getting others to join? You have got a live man as president. Now do your part.

GEO. S. BARTLETT

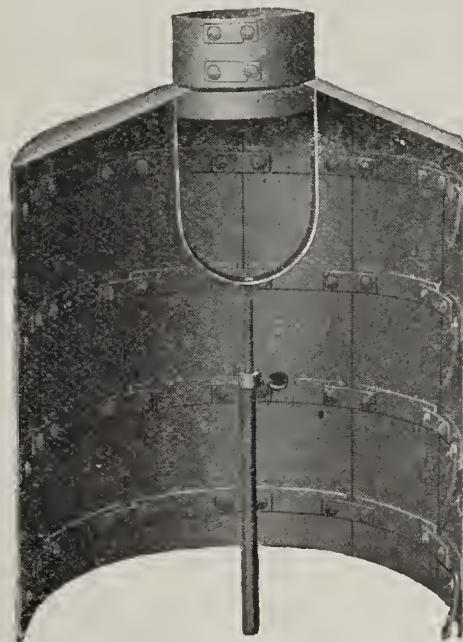
Announcement has been made of the election of George S. Bartlett to the Vice-Presidency of the Edison Portland Cement Co. Mr. Bartlett's many friends, formed during his 25 years' association with the cement industry, are congratulating him upon his election to his new position. He has been identified in the past with the Milwaukee Cement Co., the Western Portland Cement Co. and the Universal Portland Cement Co. He is at present a Director and member of the Executive Committee of the Cement Products Exhibition Co. The Edison Portland Cement Co., gains an official of capacity and wide experience in Mr. Bartlett.

MAKING CISTERN WORK PAY

As long as there are houses beyond the reach of city waterworks, so long will cisterns be in demand. The storage of water is a necessity for the small town or farm house, and people have found that the cistern is a pretty useful thing.

Now, what is the most economical cistern from the standpoint of first cost, durability, and cleanliness? Not wooden cisterns, for wood collects moss, and it rots, dirtying the water and imparting to it a foul odor. Not brick, for brick and mortar crumble under the action of water, and the brick dust will give water that peculiar dirty red color. Brick cisterns frequently cave in. There still remains the cement or concrete cistern, and this always proves the cleanest, most lasting and most inexpensive piece of work.

To build such a cistern forms are necessary; but most builders do not know just what these forms are like, or where they can be procured. Consequently it is a pleasure to point to the Laughlin Cistern Forms, which make concrete cistern building as simple as can be. Such forms must necessarily be strong to withstand the rough usage of inexperienced help besides the usual wear and tear. The builder wants forms that will meet all requirements where the holes are dug unevenly, and to offset the disadvantages of wet soil and cave-ins.



The Laughlin Cistern Form.

The Laughlin forms shown in the illustration are made from non-rusting cold-rolled steel. There is no woodwork to swell and crack the concrete. Neither is there any waste material as is always the case when wood forms are used. The Laughlin forms are adjustable to any size to give a cistern capacity of from 25 to 100 barrels. With two forms, the capacity can be increased to 500 barrels. The arches are collapsible, and will not dip. In setting up the forms a hammer is the only tool required. And they are just as easy to take down as they are to set up.

Any builder with limited capital will find these forms sure money-makers. He can build three cisterns a week with one form, and no high-priced or experienced help is necessary. Laughlin forms provide a simple and practical method of making cisterns for anyone who knows how to handle concrete.

You should write the Laughlin Manufacturing Company, care of Cement & Engineering News, 1117 Schiller Building, Chicago, for further information.

CEMENT MILL NEWS

The Fuller Engineering Company of Allentown, Pa., have closed a contract for the designing and construction of the new plant for the Dominion Portland Cement Company, Ltd., which is to be built in New Zealand at Whangarei, near Auckland.

MORRIS COUNTY TURNPIKE ARCH AT HOPATCONG, N. J., D. L. & W. R. R.

By A. M. Wolf, C. E.

When the Slateford-Hopatcong cut-off of the D., L. & W. R. R. is mentioned one thinks at once of those splendid concrete structures, the Delaware River Viaduct and the Paulin's Kill Viaduct. The magnitude and beauty of these structures overshadow and distract attention from the smaller structures of which there are many. All of these bridges, both overhead highway and railroad, are of a high standard of engineering and architectural design. One of these structures, which is very attractive on account of the rusticated surfaces, is the 40-foot skew span arch over the Morris County turnpike in the Musconetcong Fill, near Hopatcong, N. J., built in 1910.

Design.

This circular segmental arch carries three tracks and is placed on a skew of 60 degrees with the center

within the middle third, thus producing no tension, excepting that which would obtain due to temperature changes. The latter is taken care of by the reinforcing steel in plane of extrados and intrados. The analysis was made on the basis of a skew span, that is on a section parallel with the center line of track, and was built accordingly. By keeping the line of pressure within the middle third for this ring and loading, the compressive stresses were kept much lower than is the usual practice of this road, having a maximum of 300 lbs. per square inch not including temperature stress.

Details of Design

The abutments are of class C plain concrete of a 1:3:5 mixture with large stones embedded, and are designed so that the maximum pressure of the toe is $5\frac{1}{4}$ tons per square foot. The bottoms of footings are at least 4 ft. below the surface, and deeper where the conditions demanded, in order that a safe bearing value of $5\frac{1}{2}$ tons per sq. ft. could be used. Abutment faces are vertical and the backs are sloped so that the width at the top of footings is 22 ft. 6 in., the footings



Morris County Turnpike Arch., D. L. & W. Ry.

line of tracks, the length of barrel being 74 feet 5 inches. The arch ring is 2 feet 9 inches thick at the crown, 6 feet $7\frac{3}{8}$ inches thick at the spring, and has a rise of 12 feet, the total clearance at the centerline of roadway being 25 feet.

The structure was designed for Cooper's E-50 loading with impact in accordance with the following formula:

$$\frac{\text{Impact}}{\text{Live Load}} = \frac{\text{Live Load}}{\text{Live Load plus Dead Load}}$$

The live load was assumed as spreading over a 13 ft. width of arch ring and the fill as acting vertically. The fill over this arch is not very deep, but in greater depths the same assumption is made with the live load spreading through the gill on a slope of $\frac{1}{2}$ to 1 from each end of tie. The live loading now being used by the D., L. & W., in the design of similar structures, is 60,000 pounds on each of four axles on 5 ft. 6 in. centers.

The arch ring was analyzed for three different conditions of loading, viz.: (1) Live load over entire span; (2) live load over half span; (3) dead load only, and so proportioned that the line of pressure is everywhere

being 3 ft. thick with 1 ft. projections at the face and 1 ft. 6 in. at the rear. The height from top of footing to the springing line is 15 ft. The skewbacks are serrated or sawtoothed, as shown in the accompanying detail, making the bearing surfaces of the joint normal to the lines of thrust from the arch.

The wing walls are of the plain gravity type, composed of class C concrete, with stepped backs and a face battered at $\frac{3}{4}$ in. to 1 ft. One wing wall at each side of the bridge is parallel with the face of the abutment, while the other makes an angle of 29 degrees 52 min. with the line of abutment face; these latter wings are 32 ft. 9 in. long, while the former are 48 ft. 2 in. and 52 ft. 4 in., respectively. The tops of the wings are 2 ft. wide and stepped so as to form a slope equivalent to $1\frac{1}{2}$ to 1. The height above footing at the point of connection with the abutment is 31 ft. 4 in. and the base width normal to the face of wing is about 16 ft. or over 0.5 of the height for the long walls, and 14 ft. or 0.45 of the height for the short walls. The backs of walls are built in steps 1 ft. 8 in. high with 6 in. projections at the rear. Wing wall footings are 3 ft. deep and project 1 ft. beyond neat-lines.

The curve of the arch ring is a segment of a circle with an intradosal radius of 22 ft. 8 in. and an extradosal radius of 30 ft. The arch ring is reinforced longitudinally with 1 in. square bars, 2 ft. centers, 4 in. from extrados and intrados and $\frac{3}{4}$ in. square bars, 2 ft. centers, transversely just below and above the longitudinal bars in extrados and intrados, respectively. All bars were lapped at least 40 diameters at splices. The longitudinal bars in the arch ring lap with stub bars of equal size placed in the abutment so as to project for half their length. These bars in the extrados are 10 ft. long, while those in the intradosal plane are 8 ft. long. Class B concrete, a 1:3:5 mixture, was used in the arch ring.

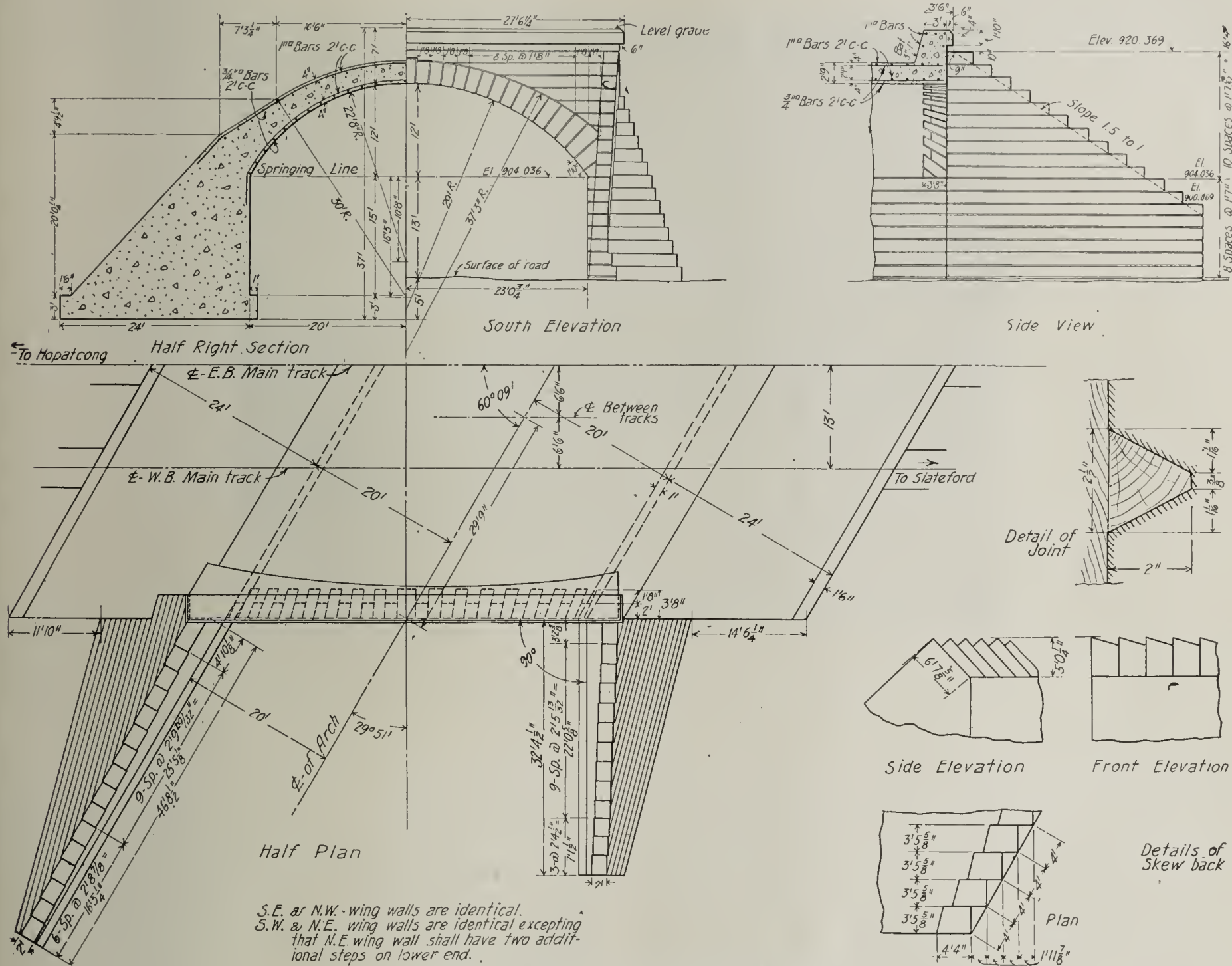
The spandrel or parapet walls retaining the fill over

Quantities

Fourteen and one-half tons of steel were used in this structure and the concrete required, amounted to about 3,220 cubic yards.

Surface Treatment

The showing faces of parapets, abutments and wings have horizontal coursing joints or scorings 1 ft. 8 in. centers. The upper line of the arch ring is delineated by a similar false joint and the arch ring is marked off into voussoirs or ringstones on radial lines, extending back on soffit in lines normal to the face. At the crown, the date plate gives the appearance of a keystone. These joints, a detail of which is given, are 2 in. deep and $2\frac{1}{2}$ in. wide at the face and $\frac{3}{8}$ in. at the back.



Details of Morris County Turnpike Arch.

the arch ring have a width of 3 ft. under the coping which projects 6 in. beyond the vertical face of wall. Parapets have a back batter of 3 in. to 1 ft. and are designed as plain gravity walls. Five longitudinal bars (1 in. squares) are used in the parapet to prevent the formation of cracks. Three of these bars are in the top of coping and the other two are near faces of wall just below coping. The coping is 1 ft. 10 in. deep and the outer edge has a 4 in. bevel. Tops of parapets are 4 ft. 3 in. above the crown of arch, with the base of rail 3 ft. 11 in. above this, making the fill at the crown about 8 ft. deep. Class A, or concrete of a 1:2:4 mixture, was used in the copings, and class B in the remainder of spandrel walls.

There can be no denying that the appearance of the structure is greatly improved by the method of surface treatment used, the rusticated surface effectually hiding all horizontal construction points and breaking up the surface so that the form-marks are practically unnoticeable. The cost of the structure was increased very little by this rusticating of the surface, while the beauty of the bridge was greatly enhanced thereby.

The arch was designed and built under the direction of Mr. G. J. Ray, chief engineer; Mr. F. L. Wheaton, engineer of construction, and Mr. T. Burke, contractor. We are indebted to Mr. A. B. Cohn, concrete engineer, for data and illustrations used in this article.—Railway Engineering & Maintenance of Way.

ROME STATE CUSTODIAL ASYLUM

At the Rome State Custodial Asylum there have recently been erected buildings with roofs that are worth study by designers in concrete. In these buildings the floors, roofs and roof framing are all of reinforced concrete. The roofs are pitched at forty-five degrees, are made up of slabs four inches thick of a 1:2:5 mixture of cement, sand and cinders and were covered with slate set in cement directly on the concrete slab.

The construction has been very satisfactory and promises to eliminate the one objectionable feature of slate covering, the liability to breakage, as the slate has a perfect bed in the cement mortar.

of aggregates; if by rail, on the rear of the building. The size of the mixing plant is determined by the amount of concrete to be mixed for the entire job, the time allowed by contract to complete mixing, and the maximum quantity that has to be placed in a single day. Usually this can be done by one mixer taking as a charge a barrel of cement and aggregates in any proportion.

"A common arrangement for the concrete mixing plant is to lay an industrial railway track so that aggregates are unloaded direct from the steam railroad into industrial cars, which dump directly into a super-hopper, set flush with the ground, over the mixer. A pit dug outside the building is made sufficiently deep to



Reinforced Concrete Floor Construction. Rome State Custodial Asylum. A. E. Stephens Co., Contractors, Binghamton, N. Y.

THE PLANT FOR CONCRETE CONSTRUCTION

"The study of the amount and location of mechanical plant has to be made immediately after the contract is awarded if work is to be started promptly, as part of it is put into operation with the very beginning of construction. As a good deal depends upon the amount, design and promptness of delivery, so far as economical construction goes, the best thought of the whole organization is put on the subject.

"For instance, one of the younger men made a study for a large job on the basis of a story a week. To obtain this rate one mixer and two stories of forms more were required than if the progress was slowed down to a story in nine working days. Such speed was not demanded. A conference of all hands corrected the first study, making an estimated saving in job cost of about \$10,000.

"Before the location of the concrete mixing plant can be decided upon, the source of supply for aggregate and cement must be settled, which in turn settles the method of delivery. If materials are delivered by teams, the mixing plant will usually have to be on the front of the building for the economical handling

take the super-hopper feeding the mixer by gravity, and the mixer in turn dumps by gravity into an elevator bucket that runs vertically through a steel tower just outside the wall, so that it discharges through a chute into the building. This, as well as all other tools, when possible, is driven by electric power. The pit, acting as a sump well to drain the surrounding ground, has to be pumped out," writes Leonard C. Wason, President, Aberthaw Construction Co., Boston, in a paper before the Boston Society of Civil Engineers.

CONCRETE BLOCK GARAGE

The King-Bruns Automobile Company, Coopers-town, N. D., writes us asking for the name and address of parties who might be able to furnish them with illustrations for the erection of concrete block garage and showroom, costing between three and four thousand dollars, to occupy a corner lot on which the present space is 50 feet by 115 feet not all of which will be occupied by the building. The building will be one story high originally with the possibility of a second story later.

THE WORLD'S LARGEST PRECISION TESTING MACHINE

A testing machine has recently been installed at the U. S. Bureau of Standards, Washington, D. C. This machine is used for testing columns, blocks, beams, girders, and other shapes of steel, iron, wood, concrete, reinforced concrete, etc., in order to determine the breaking strength, the spring under load, and other valuable engineering data. It is able to take specimens of any length up to 34 feet, and can exert a pull of 1,150,000 lbs., or a crushing force of 2,300,000 and yet so delicate is it that the pressure of the finger upon it will be registered.

The machine consists of two main parts connected by two enormous screws. One part is stationary and contains the mechanism by which the force exerted on the specimen is measured. The other part, called the press, is movable and consists essentially of a hydraulic cylinder mounted on wheels. The head of

MERITORIOUS SLACK CABLEWAY MACHINE

The attention of Cement & Engineering News has been called to the Negley Patented Excavator as a meritorious slack cableway machine which is operating in different states throughout the country, with seeming success and is attracting attention everywhere.

This excavator is of the rigid pattern and simple in its construction as standard parts are used throughout. It is operated by any standard two-drum friction hoisting engine at a ratio of one H. P. to the cu. ft. capacity of the bucket where steam is employed for power.

Its special construction provides for quick loading with the minimum of power, as its inner surface is smooth and apparently without obstruction which would create resistance or friction. The cables which are used to control the loading and dumping of the material are so adjusted that when the excavator is in position for loading the carrier rests on heavy cross



Reinforced Concrete Roof Construction, Rome State Custodial Asylum.

the hydraulic piston is mounted on wheels of its own and can move independently of the cylinder. The oil, which is used to produce the hydraulic pressure, is supplied through a pipe which telescopes or elongates as the press is moved.

In testing, the press is moved to the proper point, depending on the size of the specimen, by the Westinghouse motor. The specimen is then put in place, being gripped by jaws mounted on each of the ends of the testing machine if it is to be put under tension, or held between two heavy plates if it is to be compressed. The hydraulic piston is then slowly forced forward or pulled back, depending on whether the test is of compression or tension, until the specimen under test is ruptured.

A Deane pump driven by a 20 H. P. Westinghouse motor supplies the oil for operating the hydraulic cylinder. This pump is capable of delivering oil at a pressure of 3,500 pounds per square inch.

FORM REMOVAL

The Committee on re-enforced concrete of the Canadian Society of Civil Engineers has submitted to the society a draft of proposed standard specifications for plain and re-enforced concrete, according to press reports. These specifications contain a clause entitled, "Form Removal," which reads as follows:

"The forms shall not be removed until the times named in the following table have elapsed after depositing concrete, not counting periods in which the temperature has been below 35 degrees, Fahrenheit."

bars on the front of the bucket at the top, lending its weight to force the excavator down into the material. The upper line, which is called the latch line, maintains just a little slack, while the other two cables, acting in conjunction with the load line cable, perform the duty of loading. When the loading is completed, by taking up the tension line which operates over fall block, the main cable is raised which lifts the carrier until the hook engages the front cross bar; as the main cable is raised higher the latch brings the loaded bucket up with it until the proper height is reached for transmission. When the latch engages on this front bar, this latch line becomes tight while the other two cables automatically become slack, and this latch cable, acting in conjunction with the loading cable, performs the duty of transmission. When the arms of the latch come in contact with a stop on the main cable the latch arms are forced backward, releasing the hold on the cross bar; when the weight of the load is taken by the latch cable, and as slack is given to the load cable the front of the bucket moves downward, and by virtue of the adjustment of these cables and the weight of the machine and its load, the carrier is held against the stop while the material is slowly discharged.

Should it be desired to rapidly discharge the material, the operator fully releases the load cable and causes the bucket to immediately swing into a perpendicular position while the excavator starts its gravity trip to the excavation.

It has been found that this excavator is adapted to every operation where the slack cable-way machine can be employed, which would cover such field as producing sand and gravel, stripping earth, stocking and reclaim coal, coke and other materials, for construction of boulevard and roads, and for use as a conveyor in general.

There is a simple attachment which can be quickly put in place or removed which will enable the operator to discharge the load at the lower end of the main cable as the excavator is traveling backward by gravity. This attachment would seem to make this machine adaptable to conditions which would open up new possibilities in the industrial world.

with steam power, and while comparative statistics are lacking at this time good results have been obtained. The Negley Patented Excavator is manufactured by the Indianapolis Cable Excavator Co., New York street and Beauty ave., Indianapolis, Ind.

HORSE BARN WITH CONCRETE FLOORS

There has been during recent years a rapidly growing sentiment by all classes of business men for better construction of all buildings. The breeder and raiser of pure blooded stock has too large an investment in his stock to take any chances by housing them in poorly built non-fireproof buildings. No material meets the requirements for first-class stock barns



Horse Barn with Concrete Floors on the Farm of Geo. Soners, Huntington, Ind.

The slack cable-way system itself, while comparatively new, is demonstrating a broad field of adaptability. The fact that one may locate his power and mast at a convenient point and operate in a radius of almost a half circle with economy is a principal and prominent virtue of this system, and many types of slack cable-way machines are accomplishing good work along excavation and construction lines.

It is said that these machines are capable of a large daily production, while the cost of operation and maintenance is very low. Positive statistics seem difficult to obtain for the reason that different conditions and different machines produce different results, and the buyer who has need of such equipment should thoroughly investigate the virtues of the different types, taking into consideration the first cost and the simplicity of the construction of the machine, as it pertains to economic operation.

All persons familiar with machinery will realize that machines having standard parts are more liable to perform their work with economic maintenance, than are the more complicated special part machines.

In the city of Indianapolis, Ind., the Indiana Excavating Co., are constructing a section of boulevard along Fall Creek bank for the City Park Board. This section of work extends about $1\frac{1}{2}$ miles and the total excavation will approximate somewhere between 350,000 and 400,000 cubic yards. On this stretch of work four Negley Patented Excavators are employed, two of which are being operated with electricity and two

better than reinforced concrete. Throughout the middle west, where are located some of the largest stock raising farms, there are to be found concrete barns similar to the one illustrated on this page.

It is said that this building is the best planned and equipped stock barn to be found anywhere, and has given perfect satisfaction in every way. The exterior walls are of brick above the basement. Stone is used for sills and lintels of all windows and for coping. The roof is of tile. The floors are of reinforced concrete, the reinforcing steel consisting of "ECONO" expanded metal.

HERCULES CHAIN MAKING HISTORY AT THE PANAMA CANAL

The Columbus Chain Company of Columbus, Ohio, and Lebanon, Pa., has just received a letter from Mr. J. S. Kirk, engineer of steam shovel No. 222 in the Culebra Cut, Panama Canal, which was one of the shovels in operation when the excavating forces from east and west met and finished the opening of the cut. This was a matter of celebration at the canal, and the Columbus Chain Company are very proud of the achievement of their Hercules chain on the Panama Canal work.

Mr. Kirk says that shovel No. 222, of which he is the engineer, is equipped with a "Hercules" Chain which was installed on June 12, 1911, and did not break until September 20, 1913. This chain was on the shovel when the shovels met and is still in use.

LAKE PARK BRIDGE, MILWAUKEE, WIS.

By O. B. Young, Jr.

A bridge has recently been constructed over a gully in Lake Park near Milwaukee, Wis., built entirely of concrete reinforced according to the Kahn system of reinforcement. It is 216 feet long and 14 feet wide.

The abutments are 14 feet wide, 9 feet deep and run back into the earth 16 feet. They are constructed of concrete proportioned 1 part cement, $3\frac{1}{2}$ parts sand and 7 parts stone and are reinforced with $\frac{1}{2}$ -inch round rods placed in the back and spaced 12 inches c. c.

The bridge approach is constructed with 12-inch walls. Running back from the face of the abutments

nearer the crown is reinforced with two Kahn bars 1 by 3 inches and in the beam over the opening nearer the abutments, two Kahn bars $\frac{3}{4}$ by 2 inches are used. The ribs are stiffened by stout brackets 8 inches wide placed every 12 feet.

A floor designed to carry a live load of 75 pounds is placed over these ribs. This floor is a concrete slab 6 inches thick, proportioned 1 part cement, 2 parts sand and 4 parts stone and is reinforced with $\frac{1}{2}$ by $1\frac{1}{2}$ -inch Kahn bars, spanning on the arch ribs, spaced 9 inches c. c. The slab is tied together with $\frac{1}{4}$ -inch round rods 18 inches c. c. running full length of the bridge. A concrete balustrade railing is placed at the outer edges of the bridge between the abutments.

This bridge has a very artistic appearance and was put up in less time and at a less cost than a steel bridge could possibly have been constructed for.



Lake Park Bridge, Milwaukee.

20 feet they are built in an octagon shape and from there they run back, parallel with each other, 28 feet. Their walls are 12 feet apart and are brought up from the abutments to within 6 feet of the grade by a series of steps. The octagon walls rest upon footings 24 inches wide and the parallel walls upon footings 18 inches wide. On the tops of these walls is placed a solid concrete railing. Between these walls is placed an earth fill.

There is 118 feet between the face of the abutments, which is spanned over with two arch ribs with a spring of 18 feet. These ribs are 12 inches wide and have a depth of 5 feet at the crown. They are constructed of concrete proportioned 1 part cement, 2 parts sand and 3 parts stone and are reinforced with Kahn bars. The reinforcement carrying the bridge is 4 Kahn bars 1 by 3 inches made continuous and spliced with turnbuckles. Two of these bars are placed in the bottom of the ribs and two are inverted and follow the arch 4 feet 2 inches from the bars in the bottom. In order to make the bridge as light as possible, two openings have been placed in each of the deep parts of the ribs near the abutments. These openings are placed so that upper and lower beams are formed. The lower is the above mentioned beam; the upper beam is really four beams, one over each opening. The beam over the opening

CAR SHORTAGE

To what extent shippers have co-operated with the railroads in their campaign to prevent car shortages by loading equipment to maximum capacity is shown by the figures issued by the traffic department of the Universal Portland Cement Company for 1913. This company shipped 10,383,111 barrels of cement in 53,585 freight cars in 1913, as compared with 7,686,047 barrels shipped in 43,097 cars in 1911. The figures indicate a maximum loading of freight cars in 1913, which was not the practice in 1911. An average of 194 barrels were loaded in a car last year, the loading having been increased from 178 barrels in 1911. This increase in car load saved the use of 4,747 cars which would have been required additionally to move last year's traffic on the basis of the loading in 1911.

This industrial concern has reduced the number of cars required to handle an increasing business by loading the cars to capacity plus 10 per cent. A campaign was conducted with the trade and selling forces of the company so that orders would insure maximum loading of cars.

Other shippers are carrying out the principles outlined for the prevention of car shortages, but the results obtained by the cement company on such a big scale have attracted special notice in transportation circles.

CONVENTION OF THE SAND-LIME BRICK MANUFACTURERS' ASSOCIATION

President's Address

At the close of the Toronto meeting one of our members raised the question, "In what respect does the last convention differ from the earlier ones?" The reply was given at some length, reviewing the history of the industry and bringing out the present attitude of the association regarding the product of our factories. In the early years the industry was in the hands of the promoters, and the members of the association were farmers, bankers and grocers, who were in the brick business. The promoters had talked dividends so long and earnestly that the minds of all were upon dividends, and the troubles in the plant were troubles largely because they interfered with dividends. Let it be understood that this description does not mean to disparage dividends—no industry can endure long, no matter what the quality of the output may be, if there are no adequate returns.

The association at the present time is an association of brick-makers, who have come to recognize that the making of dividends and the permanence of the industry depend upon quality. I know of no organization of manufacturers in any line which stands

experience with clay-brick, but those who have had such experience know that the makers of clay-brick have troubles of their own. Some years ago a public school building was under construction in this city. The contractor bought and stacked on the job about 500,000 hard burned shale bricks. The contractor met financial reverses and abandoned the contract. While the reletting of the contract was pending, the brick stacked in piles, went through an ordinary winter. The new contractor took over the brick, expecting to get 500,000 brick. With the advent of spring it was found that the hard burned shale brick had turned to dirt and it wasn't good clean dirt at that. The factory that made these brick is still working. There was no demand for it to make good. So far as I know the incident has not interfered with a single sale for the plant, and aside from a few persons directly interested the affair passed without notice.

I have seen hard burned shale brick dumped on the job hot from the kiln, break and split while still hot, until the pile seemed to have a creeping, crawling, sort of life. I have seen clay-brick stacked under cover at the kiln turned to dirt piles over winter, but I have yet to know of a plant that closed down for this reason.



Duval High School Building, Jacksonville, Fla.
Built of Sand-Lime Brick M'd by Bond Sandstone Brick Co., Lake Helen, Fla.

more firmly and consistently for quality than does the sand-lime brick industry. All through the discussions there has been a strong, firm and dominant note—quality. The ever present question has been how to make better brick, and when questions of economy in operations have been debated, it has always been taken for granted that they were not worth consideration if they involved a product in the slightest degree below the best. There is no doubt that this attitude of our members is a permanent one. It will become stronger as the years go by, and this association will do more than its share in establishing high standards of honor and service in building material. On the other hand there are some considerations worthy of note at this time suggested by certain tests reported at our last meeting. There is in them no great reason for discouragement and not the slightest reason for alarm. All data regarding building material has value only when the data is compared with data regarding similar material.

Now, it has been and is the policy of this association to refrain from fault-finding and criticism when discussing the merits of our product as compared with clay-brick. Many of our members have had no

I refer to these things, not to find fault with clay-brick, but to emphasize the fact that in the midst of entirely new problems of manufacture, management and marketing, we are making magnificent brick and making new standards, not only for ourselves, but standards to which the other fellow will some day have to measure up when we compare our products with any similar product in quality and relative cost. We have every reason to be proud of our work, to be encouraged with the results achieved and to meet the future with courage and equanimity.

CONCRETE FOUNTAINS

Utility and permanence combined with simplicity and beauty of design were the ideals sought and realized in the concrete drinking fountains recently completed in the city of Janesville, Wis. The fountains were designed by C. V. Kerch, the city engineer, and constructed under his supervision by workmen in the employ of the city. Both are novel in that they furnish drink for man and horse and dog, and one of them is equipped with a special bowl for the use of small ponies.

LUTEN CONCRETE BRIDGES

Why use Luten designs for concrete bridges? is the title of a circular just issued by Daniel B. Luten, engineer, Indianapolis, Ind., and the following reasons are given:

1st. Because it insures the assistance of an expert in design and construction.

2nd. Because it saves more than 50 per cent of the steel required for reinforcement, yet secures a stronger bridge.

3rd. Because it saves upwards of 50 cents per cubic yard in cost of placing concrete.

4th. Because it will save 5 per cent of the total cost in efficient design of centering and forms.

5th. Because it provides **guaranteed** estimates, thus insuring reliable contracts.

6th. Because contractors may be sure of reasonable profits on Luten Designs and thus can be compelled to do good work.

7th. Because upwards of 550 concrete bridges have been erected on Luten Designs by experienced contractors under all the varying conditions existing throughout the United States. "Practice makes perfect."

8th. Because infringement of patents is thereby avoided. Luten designs are protected in the United States by twenty-six letters-patent on **cost-saving** devices.

9th. Because the charges for royalty and engineering services are less than the saving effected in steel reinforcement alone.

10th. Because no patented devices are manufactured or sold in connection with Luten Designs. Payment of the engineering fees secures the right to use any or all of the Luten patents and expert engineering.

Suits have been won with damages and injunctions against twenty-seven infringers of Luten Patents.

No suit based on a Luten patent has ever been lost or dismissed.

EXTERIOR PLASTERING

We have read with much interest the specifications adopted by the Associated Metal Lath Manufacturers, Youngstown, Ohio, for exterior plastering, printed in the March issue of Cement and Engineering News. We note with much satisfaction that details of the structural parts of the building have been given much attention, as these have in our judgment been one of the most prolific causes of failure of the stucco in the past. Our limited knowledge of metal lathing and its application does not permit us to offer any judgment or criticism regarding the method specified for the application of the lath, but we have made a careful study of the materials for the plaster, and it is of this we venture a little criticism, writes Stuart Mannell, Manager, International Lime Company, Sumas, Wash.

In paragraph 8 under the sub-head, "Preparation of Mortar," you state, "Lime when used shall be measured in the form of putty; Hydrated Lime shall be made into putty before being measured." In our judgment and experience this is entirely wrong. One of the chief advantages of hydrated lime when used in combination with cement is that it blends intimately in the dry form with the cement grains. The lime particles, being considerably finer, and of a flaky nature, they envelop the cement grain to a considerable extent, and thus produce uniform results. Moreover, under paragraph 8, latitude is permitted for using lime putty, presumably being made by hand, from lump lime slacked on the work. The general

experience in this section of the country leads to the belief that this combination will never give satisfaction, for the simple reason that the shrinkage of lime putty is much greater than that of an equal amount of hydrated lime. This tends to increase the hair checking which is a prevalent and constant failing of Portland cement stucco.

We would suggest in amendment to paragraph 8, that you recommend the use of 30 pounds of hydrated lime to each sack of Portland cement for the scratch coat, and equal portions by weight of hydrated lime and cement for the brown and finish coats. The function of hydrated lime in this class of work will be to hold the mixing water and prevent too rapid evaporation. This is the main cause of checking and lime failure on the part of some cement stuccoes. Also, the increased plasticity of such a mortar will permit the use of a larger proportion of the sand, which also will aid materially in reducing cracking, and make the mortar more popular with the workmen, on account the increased plasticity and ease of spreading. Such a mortar would also permit of considerably less care in the treatment and protection after application, and this is one of the hardest things to get from the ordinary workman or contractor.

This company is spending much time and energy in the promotion of exterior stucco, both on metal lath and solid walls. It is our belief it will be necessary that extreme care shall be given to the type of lath used and the method of application, and also to the quality and mixing of the mortar to be applied, before exterior stucco will become popular enough in this locality to be used extensively. Approximate mixtures such as those suggested have been used by us with perfect success in every case, although it is true we have given our personal attention in most instances to the application of the lath and plastering afterward.

UNITED KANSAS CEMENT CO.

Charles F. Scott, former congressman of Iola, Kas., was appointed receiver of the United Kansas Portland Cement Company by Judge Pollock in the federal court in Kansas City, Kas., last month. Application for the receivership was made in Fort Scott by the Longville Lumber Company, the Faeth Iron Works of Kansas City, Mo., and the Independence Mining and Transportation Company.

The cement company was capitalized at 3,000,000 and has three plants. The plant at Le Hunt ceased operation six months ago; the one at Iola two years ago, and the third and least valuable plant at Neodesha, six years ago. The application for the receivership recites that the Commerce Trust Company of Kansas City, Mo., took possession of all the property last November, but that as the company had no income, the trust company did not see fit to expend moneys for needed repairs.

The roofs on the plants are leaking and exposing valuable machinery to the weather, it is said. The petitioners recite, too, that several car loads of empty cement sacks are standing on switch tracks beside the plants, and that the railroads will not allow them to be unloaded until freight charges are paid. In the meantime demurrage charges are piling up.

The applicants for the receivership do not specify the amount that the cement company is indebted to them, but suggest that a receiver, who will appoint watchmen to guard the property, and employ laborers to make repairs, is needed to protect the interests of the stockholders and creditors.

A PRACTICAL SAND AND GRAVEL PLANT

The Western Sand and Gravel Company of Spring Valley, Ill., produce annually a large amount of gravel for constructing "good roads" throughout their state, and other purposes.

Their plant consists of a drag-line arrangement by means of which material is drawn from the pit and dumped into a car upon an incline. This incline runs to the top of a tippie where the car is dumped into revolving screens, where all material that is larger

CEMENT RATES ARE AMENDED

Acting upon the application of the Texas and Pacific Railway Company, the state railroad commission, Austin, Texas, has amended its commodity tariff No. 36, applying on the transportation of cement.

This amendment provides a rate of 15 cents per 100 pounds on cement, car loads, minimum weight 40,000 per car, from Hays and Eagle Ford to Galveston, Texas City and points intermediate between Galveston, Texas City and Houston.



Plant of Western Sand & Gravel Company.

than 1½-inch is rejected at the end of the screen and then passes to the crusher, where it is reduced to the required size.

Across the pit is stretched a cable to which is attached a movable sheave through which the rehaul line runs. By moving this sheave either way the bucket can be started wherever desired. The bucket will haul from 1½ to 2 yards of material at one pull, and its contents is dumped into a trap opening which leads to the car beneath. The system is operated by a three-drum double engine, and ¾-inch Leschen's Hercules wire rope.

From the loading trap to the top of the tippie is about 200 feet, and Hercules wire rope is used here also.

The daily capacity of the pit is about 900 tons based on an 8-hour day, and this when pulling from a distance of from 100 to 150 feet.

When this plant was started it was necessary to strip from two to four feet to get down to the gravel beds, and for this purpose their drag-line outfit was used to good advantage, the stripping being pulled into an adjoining ravine. After this thin stripping is removed, it is said that the gravel is free from all clay and foreign substances, and is particularly suited for use on hard roads.

The superintendent of this plant is Mr. E. Huwald, who also looked after its installation.



The Tippie.

CONCRETE DRAIN TILE

Referring to the letter of William Passage of Bailey, Mich., which appeared on page 3 of the January issue of Cement and Engineering News, regarding the failure that Mr. Passage had in making a good, strong cement, drain tile on a small hand-power machine, will say that from the correspondence of Mr. Wm. Passage it appears that the tile was not made right. A mixture of one part cement and five parts sand is not used by any conscientious manufacturer. Tile should be made from a mixture of one part cement to three parts sand, writes Geo. P. Dieckmann, chief chemist, Northwestern States Portland Cement Co., Mason City, Iowa. At some places where the sand is very well graded and proper attention paid to the manufacturing, a mixture of one part cement and three and one-half parts sand might be used. Unless cement tile is properly cured in the steaming room, the same should never be laid in the ditch before being thirty days old. Sixty days is even better. It further appears as though this cement tile made by Mr. Passage has been too dry. I would advise Mr. Passage to look in to the matter of the manufacture of cement tile by visiting an up-to-date tile plant where modern methods are used. I do not know much about the Farmers' tile machines, with which this tile was made, but I have been advised that this company is putting a machine on the market, claiming that everyone can make his own tile, but experience has shown that this cannot be successfully done. Cement tile should only be manufactured by an up-to-date manufacturer with experience and a knowledge of the conditions of concrete. It is from these causes, cement tile manufactured with any modern equipment and experience, that cement tile does not give the desired results.

CONCRETE DRAIN TILE

I have noted with interest the letter of William Passage in the January issue of Cement and Engineering News regarding the failure he had with the cement drain tile made on a small hand-power machine.

I can not give an opinion of value regarding the causes of the failure without knowing how the tile was made, how the mortar was tempered, and the chemical and physical character of his sand and cement.

Personally I have gathered much substantial evidence to support my conviction that cement concrete made of proper materials, and so made as to be thoroughly dense and impervious, will never soften in any ground or any water, writes Arthur S. Bent, contractor, Central Bldg., Los Angeles, Calif.

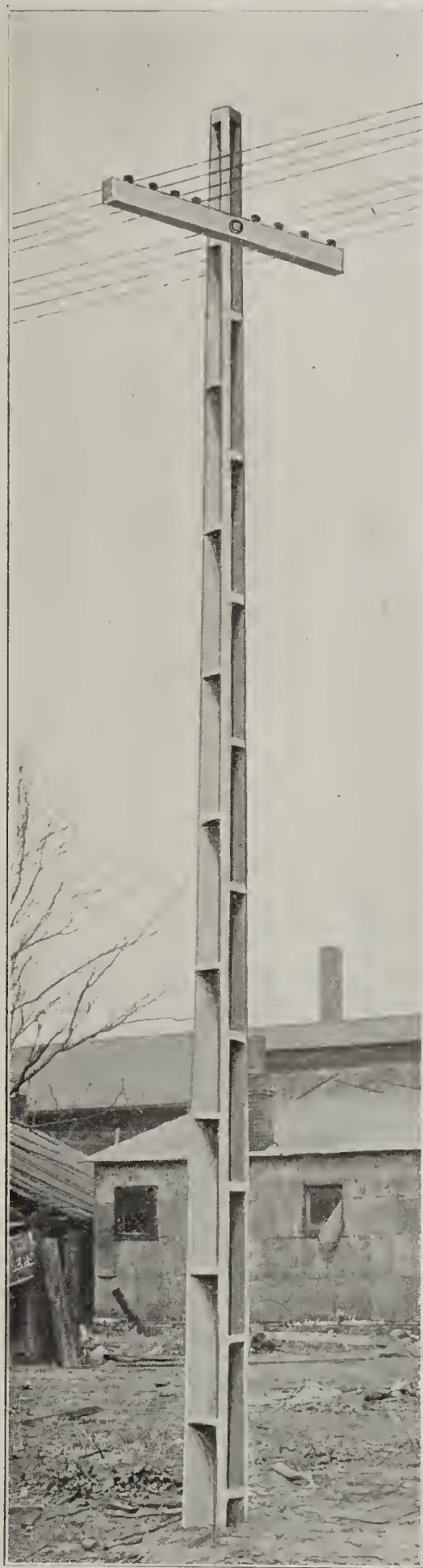
Black alkali will attack and disintegrate an improperly made pipe, but we have lines many years old, laid through the worst of black alkali soils and continually soaked in alkali waters, which are in better condition than when installed.

A notable line of this sort was one we built in Colorado for the city of Longmont, running through the town of Hygiene. Several miles went through low wet ground so saline that it would take the hair off the hoofs of animals which were exposed to it. For further details of this construction and its present condition, you might address Mr. C. E. Richardson, City Engineer of Longmont, Colo. This is only one of many cases.

Mr. Passage probably made his tile too dry; probably did not know the constituents of his sand; probably did not have his sand so graded as to fill all the voids; and possibly may have made the pipe in too low a temperature. Any one of these causes, without considering the nature of the cement itself, might easily bring about its destruction under certain conditions.

CONCRETE POLES

The increasing demands of the telegraph, telephone, light and power companies, and the rapid progress of electric traction, together with the increased scarcity of suitable timber poles, has compelled engineers to seek a suitable substitute possessing the desirable qualities of wooden poles and eliminating the necessity of continual maintenance and frequent renewals.



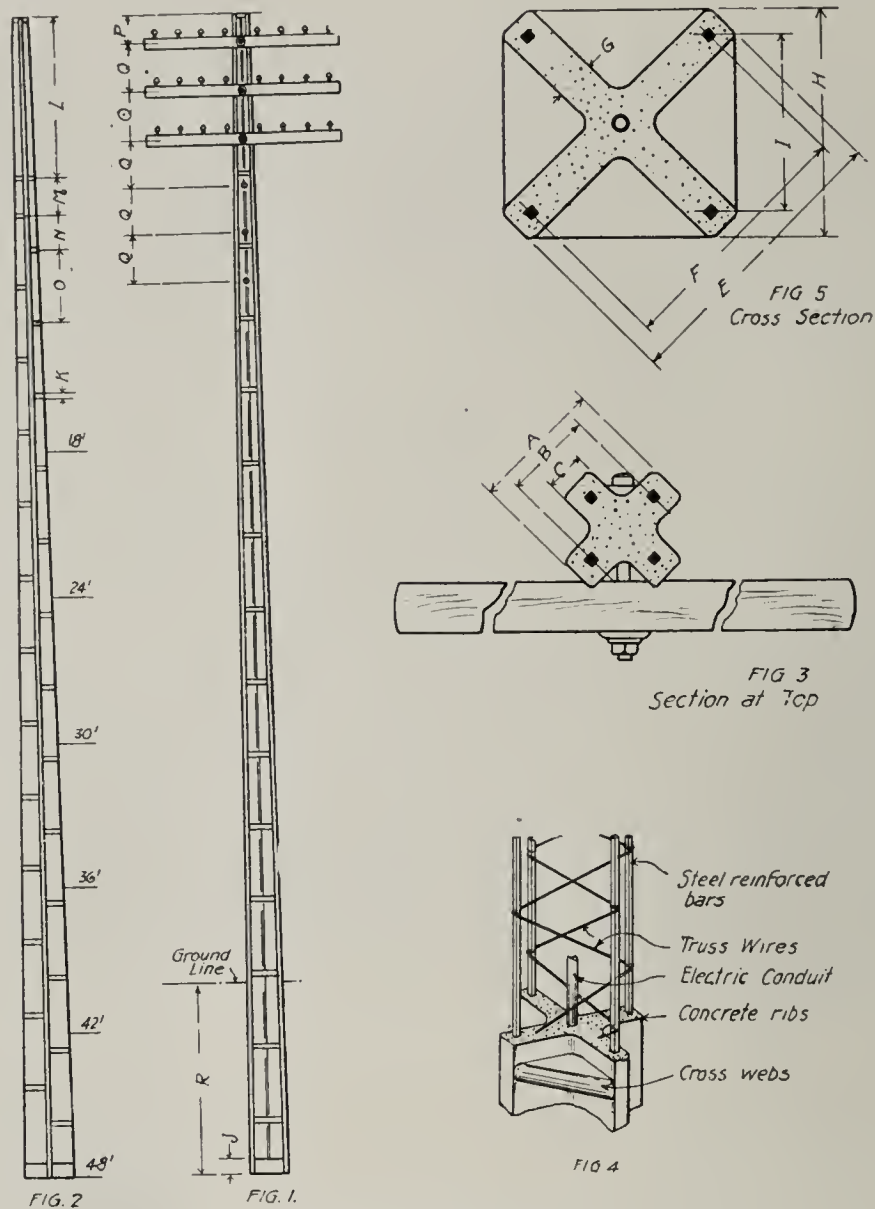
Photograph and Plan of Star Concrete Pole.

There are already in the field patented concrete poles. Some poles, which will hereinafter be designated as square poles, are merely solid concrete shafts, square in cross section and reinforced with steel rods and wire hoops. On account of their excessive weight they are not transportable, and it is necessary to erect a vertical wooden form and pour them from the top in the field. The cost of square poles is there-

fore quite high. Another serious disadvantage to the square pole is the fact that they cannot be climbed without the use of metal spikes which are cast in place. Such spikes will rust or break off and it is a difficult matter to replace them without considerable expense. The steel reinforcing which is usually employed in the construction of square poles is difficult to hold in its proper position while the concrete is being poured. The actual strength of such poles is, therefore, variable and a very great factor of safety is necessarily employed. In other words, the square

It is an undisputable fact that all concrete products which can be produced in a properly equipped plant are far cheaper than those which necessarily have to be made in complicated wooden forms and erected in the field.

The result of recent tests has proven conclusively that these poles are more flexible than the square type. They are far better than wooden poles inasmuch as the elasticity of steel reinforcement, prevents them from falling to the ground when subjected to breaking loads.



Sections, Star Pole.

pole is usually made much heavier than absolutely necessary in order to allow for faulty construction, which is unavoidable in the field.

The star pole, constructed according to Aschauer & Lienesch patents, is an entirely different proposition. It utilizes a minimum amount of concrete which is compressed into mechanically perfect metal moulds so constructed that the steel reinforcement is absolutely held in its proper position until the initial set has occurred. This pole depends upon the concrete merely as a protection for the fabricated steel reinforcement, which is figured to develop the entire strength of the pole.

These poles weigh only two-thirds as much as any square concrete pole of equal strength, and owing to their light weight can be produced at central plants, transported and erected the same as wooden poles. They can be readily scaled or climbed, using the cross webs as steps, are free from all exposed metal parts, and are more stable against wind pressure, owing to the "saw buck" section acting against the earth resistance. They are naturally neat in appearance and may be modified to suit the most fastidious.

A company is being organized by Walter H. Lienesch, consulting engineer, 1032 National Life Bldg., Chicago, to place the concrete poles described herein on the market.

DEVICES TO GUARD ANTHRACITE MINERS

Concrete Replaces Wood Below Ground in Order to Eliminate the Danger of Fire

A representative of some of the leading mine owners and operators in the anthracite field, describing yesterday the chief features of the measures recently adopted to prevent accidents, said the Pennsylvania coal mines were now as safe as it was possible to make them, says the New York World.

"For example, that most terrible of dangers, the fire peril, has been reduced to the minimum by the removal of all wood and combustible materials from the inside of the working mines and the substitution of concrete," he said. "The same is true of fan houses, hoisting engine houses, and all other buildings on the outside, which contain machinery, and the destruction of which by fire would affect in any way the safety of men underground."

BOOK REVIEWS

General Specifications for Concrete and Reinforced Concrete, including Finishing and Waterproofing, by Jerome Cochran, B.S., C.E., M.C.E. pp. xxiii + 274; Nostrand Co.; 1913; \$2.50 net. Sent on receipt of price by Cement and Engineering News, 1117 Schiller Bldg., Chicago, Ill.

This book is the latest of a series, by the same author, dealing with concrete construction and allied topics. In his preface, the author states that there is yet room for individual work in the field covered by his book, in addition to the valuable work already accomplished by the committees of the several engineering societies, for no other reason than that there still remain quite divergent views not only as to the substance, but also as to the form, scope, and phraseology of specifications. The purpose of the book is express as an endeavor toward producing a set of specifications that will be of increasing influence for good concrete construction.

The subject matter is divided into nine chapters and the treatment is exhaustive and detailed, a considerable amount of space being given over to bibliographies and references. Detailed precautions to insure good work and guard against all possible contingencies are given and are very complete and in conformity with good practice. This feature should make the book of value to the engineer of limited practical experience in concrete construction, both in the writing of proper specifications and in superintending work. However, he should guard against allowing his enthusiasm over good specifications to carry him to unnecessary refinements, which may increase the cost and retard the pro-

gress of the work without appreciable increase in quality. Emphasis should be laid on the fact that it is not wise to adhere too closely to any set of specifications, but to judiciously compile a set for each particular job in such manner as to attain the desired quality of work at a minimum cost.

Chapter I deals with Concrete Materials, giving the usual specifications for cement, sand, broken stone and gravel. Chapter II takes up the Proportioning and Mixing of Concrete; Chapter III, Forms and Centering, and Chapter IV, Steel Reinforcement.

Chapter V on the Transporting and Placing of Concrete; Chapter VI on Finishing Concrete Surfaces; and Chapter VII on the Waterproofing of Concrete Work are well presented and give many valuable suggestions. Chapters VIII and IX give the elements of design and details of construction for various types of reinforced concrete work and are in general conformity with standard practice.

The arrangement and presentation of the subject matter is excellent and readily referred to, although much of it could be condensed and duplication avoided.

PRACTICAL HOMEBUILDING

Practical Homebuilding is the title of a booklet gotten up by the Northwestern Expanded Metal Co., Chicago, Ill., describing and illustrating by photographic views and drawings how attractive residences can be built at moderate cost by making use of stucco and expanded metal. The publication contains a large number of designs for from ten to twenty room houses and is well worth sending for, as ten cents to cover postage is the only charge made.

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No Guide Idlers Necessary—
No Spillage—**

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PORTLAND CEMENT OUTPUT

According to returns received by the United States Geological Survey up to Jan. 12, 1914, it is estimated by Ernest F. Burchard that the quantity of Portland cement manufactured in the United States in 1913 was approximately 92,406,000 barrels, compared with 82,438,096 barrels in 1912, an increase of about 9,967,900 barrels, or 12 per cent. The estimated shipments of Portland cement during 1913 were 88,853,000 barrels, compared with 85,012,556 barrels in 1912, an increase of about 3,840,400 barrels, or 4.5 per cent. On account of a large surplus of production over shipments, stocks of cement at the mills apparently increased more than 45 per cent, or from 7,811,329 barrels in 1912 to 11,375,000 barrels at the close of 1913. In 1913 the relations between production and shipments were the reverse of those for 1912, when shipments exceeded production. It may be necessary to revise considerably the estimates of stocks, but it is believed that these figures for production and shipments are very close to those that will be shown by complete returns from all producers.

Although few definite statements as to selling prices are at hand it is evident that the average value per barrel was appreciably higher than in 1912. Increases of 10 to 25 cents a barrel are reported from several plants in the Central and Eastern states, but there were slight decreases reported from a few plants in the Rocky Mountain district.

Two new plants, both in Washington, were added to the list of producers during 1913.

SOUTHWESTERN STATES PORTLAND CEMENT COMPANY

Stockholders of the Southwestern States Portland Cement Company met in annual session recently, declared business as reported for the past year had been very satisfactory, and elected directors and officers, with Harley R. Breck of Dallas the new president.

Mr. Breck has been heretofore the general manager of the concern. The meeting was held in the morning and afternoon in the company's offices in the Commonwealth building, with some thirty of the stockholders present. Part of the afternoon was spent in inspection of the plant, five miles west of the city. The evening was devoted to entertainment.

Directors elected were as follows: C. H. McNider, Mason City, Iowa; C. H. Wagner, Minneapolis; M. J. Scanlon, Minneapolis; Thomas H. Dinsmore, New York City; M. T. Gunderson, Kenyon, Minn.; Frank G. Ray, Vinton, Iowa; C. B. Ayers, Chicago; C. I. Jones, Lincoln, Neb.; H. R. Breck, Dallas.

The directors met and elected officers as follows: Harley R. Breck, Dallas, president and general manager, heretofore secretary and general manager; C. H. McNider, chairman of the board of directors; Thomas H. Dinsmore, vice-president; C. H. Wagner, second vice-president; R. L. Lumbard, Dallas, secretary; C. I. Jones, treasurer.

RE-ELECTS OFFICERS

During the annual meeting of the Glens Falls Portland Cement Co., Glens Falls, N. Y., recently held, these directors were elected: George F. Bayle, Byron Lapham, William H. Robbins, A. Wurtemberg, E. B. Potter, S. B. Goodman, Frank W. Wait, A. W. Sherman and John E. Parry. The following officers were re-elected: President, George F. Bayle; vice-president, Byron Lapham; secretary, John E. Parry; treasurer, A. W. Sherman.

COST OF PRODUCTION

A great danger in industrial investments is the underestimating of ultimate costs of production, according to T. G. Dickinson, president of the Marquette Cement Manufacturing Company.

"Competition in the various markets is so keen that selling prices frequently are made so low that fair returns on the first manufacturing costs are not covered," Mr. Dickinson says. "Increased production occasionally reduces the first manufacturing cost, but competition more often than not tends to contribute this saving to the consumer, rather than to the manufacturer."

"Ignorance in the part of the manufacturers as to ultimate cost, including actual depreciation, and, most important of all, the return of capital, within a period of ten to twenty years to the original investor, is more often than not overlooked."

"If the investing public and the bankers were more alive to the situation capital would more generally be preserved, and the country would derive more benefit from our natural resources."

SECURITY CEMENT COMPANY

The annual meeting of the stockholders of the Security Cement and Lime Company, operating plants at Security, Washington county, and Berkeley, Berkeley county, Maryland, was held.

The following officers were elected: President, and counsel, J. Augustine Mason, of Hagerstown, Md.; vice president, Charles Warner; secretary and treasurer, Alex M. Tyree; general manager, John J. Porter; sales manager, N. K. Barber; chairman of the board, Loring A. Cover. Directors: Charles Warner, Wm. C. Robinson, Wm. G. Nolting, Douglas I. Gordon, DeCourey, W. Thom, R. N. Jackson, Samuel C. Rowland, Horatio C. Whitridge, J. A. Mason, A. D. Warner, sr., Loring A. Cover, Charles Catlett.

Mr. Catlett, who has been president in charge of the plants, will remain in the employ of the company, with headquarters at Hagerstown, Maryland. It is understood that the company had a very good business year and its cement and lime products met with great favor amongst the trade, and the sales are still increasing at a most encouraging rate. It has been stated that the company's sales for the year 1913 were considerably in excess of \$1,000,000.

The shipment of cement from the Security plant in 1913 was 40 per cent above the next best year and the shipment of lime from the Berkeley plant shows earnings in the year above operating and selling expenses were \$200,000.

BURT CEMENT PLANT PAYS BONUS

When the Burt Portland cement plant at Bellevue, Mich., closed down recently for the annual repairs, the pay envelopes of every man who had been with the company for at least one year was richer by a bonus, in some cases the extra money amounting to \$25. This was in accordance with a new plan put into effect by which the steady workers will receive a certain per cent over their regular wages. The plant closes every winter for repairs, caused by the fact that the rest of the year the machinery is never still, operating twelve-hour shifts. The plant will resume active operations in February. Meanwhile a force of fifty men will be kept at work. Between 250 and 300 men are furnished employment by this big cement plant, which is owned by Wellington Burt.

GERMAN CEMENT COMBINE BROKEN

The administration of the Rhine-Westphalia Cement Syndicate at Bochum has notified the cement factories and cement unions in Germany that, in consequence of the refusal of a number of works to prolong during the year 1914 the agreement regulating and fixing prices, the sales of cement will be free from limitation for the coming year. In order to reduce competition among themselves, fourteen Westphalian cement works which belonged to the syndicate have formed a combination to be known as the Union of Westphalian Portland Cement Works. At the meeting of the syndicate the proposition to fix the maximum sale price at 150 marks (\$35.70) per 10 tons (2,240 American pounds each) was voted down, as also the motion to suspend sales until November 1. The statement at a meeting of the Holland Syndicate that a number of Belgium cement factories, contrary to agreement, had made advance sales, has brought up the possibility that this syndicate also may find it necessary to dissolve.

The impending dissolution of the German syndicate has caused a rapid fall in the price of cement. The railroad administration at Hanover lately made proposals for the delivery of 17,000,000 kilos (16,731 long tons) of Portland cement. Bids were received from thirteen companies, varying between 13c and 16c per 100 lbs.—half or less than half of the hitherto prevailing prices.

L. E. FOSTER

L. E. Foster formerly chief chemist for the Colorado Portland Cement Company of Portland, Colorado, advises us that he has accepted the position of chief chemist with the Great Western Portland Cement Company, Mildred, Kansas.

MEDUSA STARTS HOUSE ORGAN

A recent arrival in the cement industry is the Medusa Review, published by the Sandusky Portland Cement Company at Sandusky, Ohio, which will appear at frequent intervals.

The opening number, which contains twelve pages, tells the legend of Medusa, "the earliest known maker of artificial stone," and gives an added significance to the name.

The earlier pages are composed of news and descriptive notes of general interest to cement users. Individual buildings, among them factories, elevators, churches, schools and residences built with Medusa cements, are illustrated and described. Among these is the winter home of Hon. William Jennings Bryan, near Miami, Fla., abridged from the December issue of The Cement Era. Another is the Harbor Commissioners' grain elevator at Montreal, the largest reinforced concrete grain elevator in the world.

Mr. Fred C. Printy, sales manager of the company, is also introduced to the readers of the publication. Those interested may be put on the mailing list by applying to the publicity department of the company.

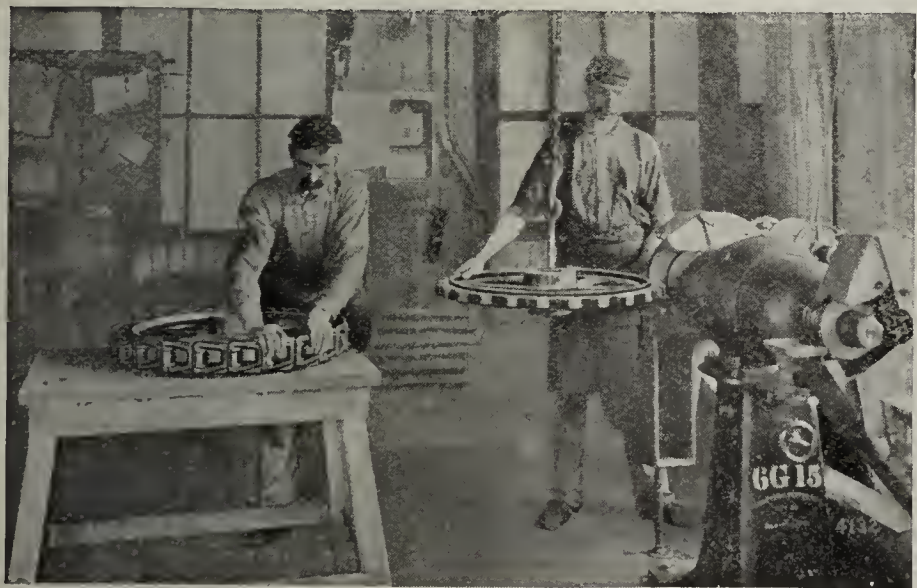
NEW CEMENT MILL FOR NEW ZEALAND

The Fuller Engineering Company of Allentown, Pa., have closed contract for the designing and construction of the new plant for the Dominion Portland Cement Company, Ltd., which is to be built in New Zealand at Whangarei, near Auckland.

E. M. Bunce, Elk Rapids, Mich., well known superintendent of various Michigan cement plants is open for a position.

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REDMAN HOLLOW WALL CONCRETE BUILDINGS

In a pamphlet recently issued by the W. T. Redman Perfect Hollow Wall Core System, Kenois Bldg., Washington, D. C., the system as developed and patented by Mr. Redman is illustrated and described. In extending the sales of territorial rights in the patents Mr. Redman is represented by Geo. E. Harris, Kenois Bldg. Mr. Harris is making an extended trip through the South in connection with the disposition of territory rights. The metal forms for use in constructing concrete buildings are being made by the Virginia Metal Culvert Co., of Roanoke, Va., and they may be obtained by contractors, builders and licensees of the patent rights by application to Mr. Redman at the Kenois Bldg., Washington, or at Brentwood, Md. The advantages and form of construction of this hollow wall system have been previously described

WASHING SAND

Any sand for use in concrete, showing signs of vegetable matter, mud or other impurities, should be thoroughly washed. The following method will be found useful: Build a platform about 12 ft. long by 4 ft. wide, with one end about a foot higher than the other. On the lower end and sides nail 2x6 in. boards to hold the sand. Spread the sand over the platform in a layer 3 or 4 ins. thick and wash it with a hose. The washing should be started at the upper end, letting the water run through the sand and out over the board at the bottom. All of the sand should be thoroughly agitated during the washing so as to allow the water to carry off the dirt. After washing, the sand should be piled up where it will not come in contact with the dirty water. Drain this water off to some suitable outlet and do not use it for mixing the concrete.—[Engineering & Contracting.]



Carpenter Steel Co.'s Concrete Building, Reading, Pa.
Muhlenberg Bros., Reading, Pa., Architects.
Geo. W. Beard & Co., Reading, Pa., Contractors.

in our columns. The use of metal forms is said to have a number of advantages over the use of wooden forms, and they will be used by the company hereafter. These metal cores are adjustable from 3 inches to 5 inches in width, from 20 inches to 36 inches in length, and are 12 inches high, so that a course of this height, from 2 to 16 feet in length, is laid at one operation. The angles are perforated at intervals of 18 inches for wire ties that pass through the wall bonds. Spacers for the uprights are adjustable for different sizes of pilasters. Forms for any style of architecture may be made to order; also imitation stone or brick pilaster forms, and special cornice forms. Cores for silo walls are also made in sizes from 10 to 24 feet in diameter. A number of buildings have been constructed by this system and satisfactory results are stated to have been obtained in every case. The plant of the Baltimore Asbestos Roofing Co., near Finksburg, Md., has been constructed by this system. It is stated that the company has found it economical, efficient and satisfactory in construction and appearance. These metal cores and wall forms are adjustable for all sizes of walls and are practicable for various kinds of buildings. The pamphlet referred to will be sent to interested persons on request.

CANADA CEMENT COMPANY

Net profits of the Canada Cement Company, Ltd., for 1913 were \$1,536,432, an increase of \$141,756 in comparison with 1912.

STATEMENT OF OWNERSHIP, ETC., FOR POSTAL AUTHORITIES.

Statement of the ownership, management, etc., of Cement & Engineering News, published monthly at Chicago, Ill., required by the Act of August 24th, 1912.

Note—This statement is to be made in duplicate, both copies to be delivered by the publisher to the postmaster, who will send one copy to the Third Assistant Postmaster General (Division of Classification), Washington, D. C., and retain the other in the files of the Postoffice.

Publisher, Editor, and Managing Editor, William Seafert, Chicago, Ill.

Business Manager, J. F. Waldron, Chicago, Ill.

CEMENT & ENGINEERING NEWS is not incorporated; it is owned solely by William Seafert; residence, 435 S. Marshfield Ave., Chicago, Ill.

There are no bond holders, mortgagees, or other security holders, outstanding against Cement & Engineering News.

WM. SEAFERT.

Sworn to and subscribed before me this twenty-third day of March, 1914.

(Seal)

ROBERT A. CLARA, Notary Public.

(My commission expires Aug. 17th, 1916.)

NEWS ITEMS

The Texas Portland Cement Co., Dallas, Tex., has arranged to make a large installation of apparatus for electric drive in its mills, comprising 71 motors ranging from 5 hp. to 500 hp., switchboard, controllers and accessories. The entire equipment will be furnished by the General Electric Company.

The Dunnellon Phosphate Co., Rockwell, Fla., is equipping its plant for electric drive and will install fifteen motors ranging from 50 to 300 hp., switchboard, switches, etc., all the electric apparatus having been contracted for with the General Electric Company.

The Oklahoma Portland Cement Co., Ada, Okla., will place in operation in its power plant a 500 kw. Curtis horizontal turbo-generator and a 625 kv-a. alternating current generator, both of which machines have been ordered from the General Electric Company.

CAN CONCRETE BE MADE IN ITSELF IMPERVIOUS?

The question of whether concrete can be made in **itself** waterproof was recently asked Leonard C. Wason, president of the Aberthaw Construction Co., Boston. In reply Mr. Wason was very emphatic in stating that not only can concrete be made impervious under ordinary pressures but even under extraordinary pressures. By ordinary pressures is meant pressures due to heads 10 feet or below, while extraordinary pressures refers to standpipe pressures. Mr. Wason states that his experience has shown that it is simply a question of well graded materials, proper proportions and thorough workmanship, to get the maximum density. With good work the Aberthaw Company have found that for maximum density a mix of 1:2:3½ is about correct, the aggregate varying from 3½:1. Mr. Wason remarked that the time the materials should

mix is very important and that on the best work they have done the materials were kept in the mixer for five minutes. The amount of water is also very important. The point of placidity can be judged by the eyesight and the concrete should just barely quake. The materials after being mixed must be handled very carefully so that there will be no separation of the same. To make impervious concrete structures great care must be taken in getting the joints clean before going on with the next day's work. In Mr. Wason's opinion 99 per cent of all leaky concrete building work is due to poor workmanship.

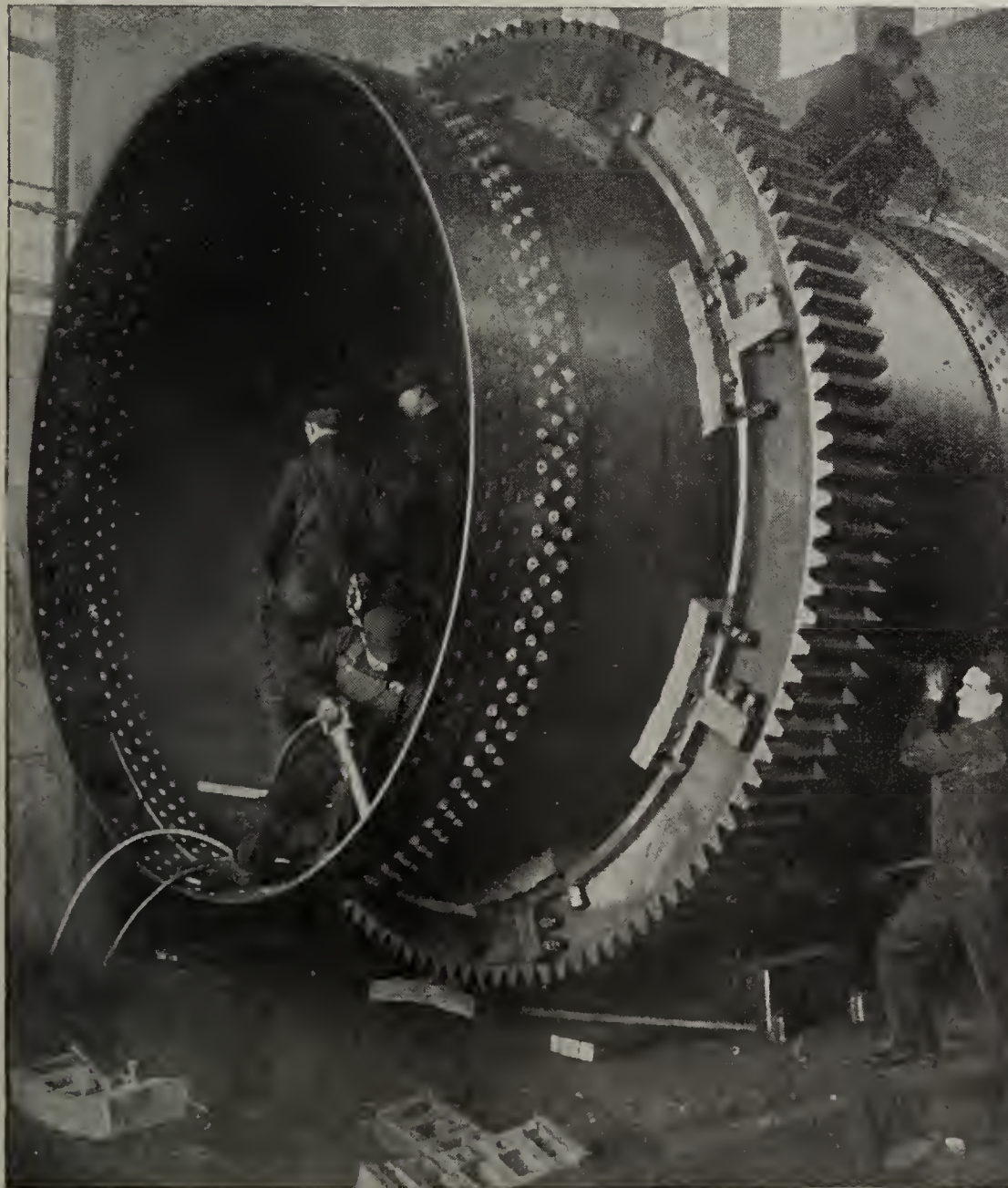
BONNOT PULVERIZERS

The Bonnot Company, Canton, Ohio have just issued a new booklet containing 15 pages concerning their pulverizers for lime and limestone. The following advantages are claimed: (1) Dustless operation, (2) grinding and screening at one handling, (3) convenient renewal of grinding parts, (4) practically unlimited screening area, (5) quick variation of screens giving variation in the fineness of product, and (6) greater capacity and fineness per horsepower expended than with other machines.

NEW CATALOG.

Dragline Cableway Excavator.—Paper, 9x6 ins.; 48 pp. Sauerman Bros., Monadnock Block, Chicago.

Describes the Shearer & Mayer Dragline Cableway Excavator, designed for handling material which cannot be economically handled with ordinary boom line or steam shovel excavators. Diagrams show the design and operation of this excavator, and numerous photographs give a good idea of the many classes of work to which it is adapted.



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Where Strength Is Needed
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REINFORCED CONCRETE CONSTRUCTION

The second volume of Prof. George A. Hool's comprehensive publication on "Reinforced Concrete Construction" deals with the subject "Retaining Walls and Buildings" and is a valuable supplement to the first volume which treated the "Fundamental Principles." A third volume will cover "Bridge Design and Construction."

This second volume, the price of which is \$5.00, contains three chapters on "Retaining Walls" and twenty-four chapters on "Buildings," their design, construction and estimating. Outside of some interesting chapters on floor construction, flat slab construction, wearing surfaces and loads, the chapter dealing with column design deserves particular mention, as the author favors the circular hooped column and shows also otherwise good judgment in selecting between safe and unsafe construction.

Detailed plans and specifications are given for buildings with full estimates of the cost, and numerous cuts taken from practice will appear especially valuable to the practical man engaging in reinforced concrete construction.

THE CONCRETE SILO IN MISSOURI

It has been made part of the duty of the dairy department of the Missouri College of Agriculture to assist the farmers of the state in constructing silos. The college has no interest in any particular kind of silo but tries to give unprejudiced information concerning all kinds that are adapted to the state. The college is interested only in having a large number of good silos built regardless of what kind they may be.

The Department of Dairy Husbandry has been led to give special attention to supplying information concerning the concrete silo on account of the misrepresentation this type of silo has received at the hand of agents for other construction.

Every silo which has been built according to the plans supplied by this department has been successful. Contrary to the reports circulated by certain silo agents, not a single concrete silo built under college supervision has cracked.

The farmers are also informed that silage will not keep in concrete silos, which statement has no foundation. Reports from over forty farmers using concrete silos in Missouri state that their silage keeps perfectly. One concrete silo on a farm near Columbia has been used five years and the owner says that not a bushel of silage has been spoiled in that length of time. The College of Agriculture has been entirely unable to locate a concrete silo where the silage has not kept when it was put into it in the proper condition.

NEW BOOK ON ROCK DRILLING

Rock Drilling. By R. T. Dana and W. L. Saunders. Pp. 319; ill., index. For sale by Cement & Engineering News, 1117 Schiller Bldg., Chicago. Price \$4.

Following a general introductory statement covering blasting and explosives, this volume treats in detail the methods and costs of open-cut excavation and submarine rock-drilling. It is based principally on material collected and compiled by engineers of the Construction Service Company, and includes accurate records of cost and drill duty in many kinds of work. Diagrams and tables are freely used in such shape as to make more than a mere record of cost. Accurate comparisons and analyses become easy. The book is well written and well illustrated and is sure to prove of large value to consulting and constructing engineers.



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A simple, rapid, efficient machine for working over a large area. It digs, conveys, elevates and dumps the material in one continuous forward operation under *positive control* of one operator.

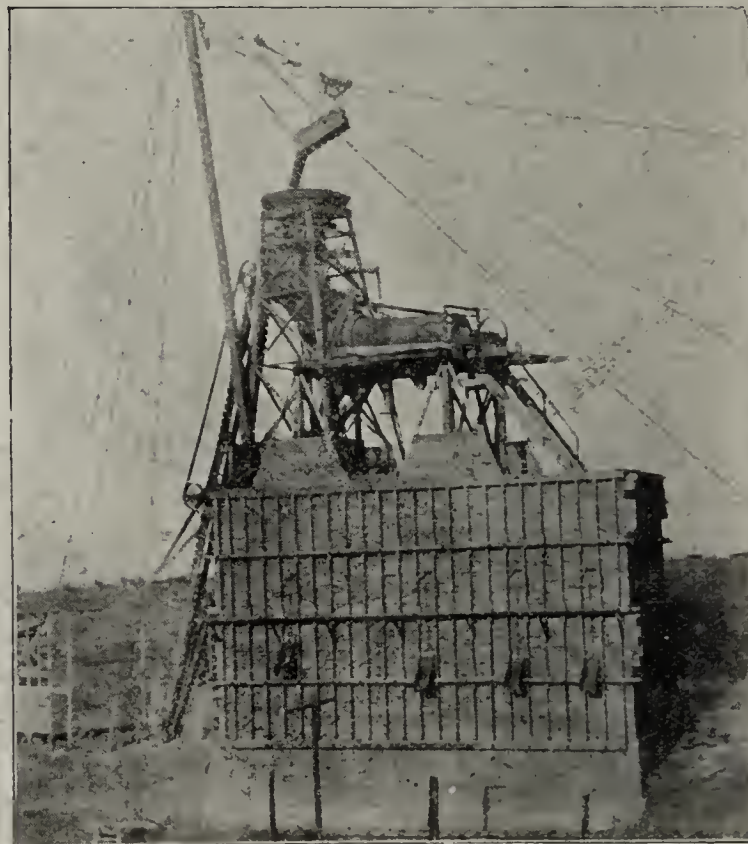
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CEMENT & ENGINEERING NEWS

Vol. 26

May, 1914

No. 5



Probably the largest pit ever built for storing coal. Built of Concrete. Capacity 30,000 tons, of which 13,000 tons are below the water level (kept at the ground level). Makes it possible to store coal as protection against strikes or car shortage. Erected in Indianapolis by the Indianapolis Light & Heat Co. There is first a large concrete pit, 300 feet long, 100 feet wide and 28 feet deep. It is 18 feet below ground level, having a 10 ft. wall above the ground. Below the ground the wall slopes at an angle of 45 degrees, this being done only to reduce the cost of construction. This gives a pit 72 feet wide and 272 feet long on the bottom. The Link-Belt Co., Chicago and Philadelphia, manufacture locomotive cranes and buckets for handling coal, sand, clinker, crushed stone, etc.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year,
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\$1.50 per year.

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month.

Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, MAY, 1914

CONCRETE ROAD CONSTRUCTION.

The national conference on concrete roads, which met in Chicago recently adopted the following principles, or ten commandments, for concrete road work:

1. The aggregates should be clean and hard.
2. The sand should be coarse and well graded.
3. A rich mixture should be used.
4. The materials should be correctly proportioned.
5. The materials should be thoroughly mixed.
6. The inspection should be intelligent and thorough.
7. When in doubt, reinforce the pavement.
8. The subgrade should be of uniform density, thoroughly compacted and drenched with water immediately before placing concrete.
9. The concrete should be of a viscous, plastic consistency.
10. After placing, the concrete should be covered immediately, kept moist, and not opened to traffic for four weeks.

Intelligent and honest inspection is needed in all public work, whether it is municipal, county, or federal. Both corporations and private interests have elaborate systems of inspection for all their work, whether done outside or inside of the plant.

Thoroughness of inspection, particularly in large cities, necessarily must be limited by the class and experience of the inspectors appointed. An engineer with much experience in dealing with contractors gave a definition of an ideal inspector as a "man who could read English, who was reasonably honest, and who could count up to ten." When the millenium arrives inspectors perhaps will be both honest and intelligent and also will possess a good working knowledge of the practical and technical points of the job they are inspecting.

Men inspecting pavements will not then be drawn from other departments and put on work which they know nothing about. It is said that one of the causes of the scandal in the New York state road department is directly traceable to the inspectors, many of whom were drawn from subway and aqueduct work to supervise road building.

Upon all road construction, and particularly in concrete, there should be two inspectors constantly "on the job." If it is necessary for both of them to leave the work, all construction should be suspended until their return. This might cost the taxpayer some money, but would be true economy in the long run.

The average citizen realizes the necessity for inspection is complex, when, as a matter of fact, it is comparatively simple and the chances of fraud can be eliminated. The citizen should know what he, as a taxpayer—and what the inspector, who is his representative—should look after to get his money's worth.

The first step in road building is a preparation of the foundation. Adequate drainage should be provided, all soft spots in the road should be filled, and preliminary grading should be done. Then the road should be rolled with a five or ten ton road roller.

For a concrete road the subgrade usually is rolled flat and not crowned, as for other road materials. The foundation having been prepared, the material, which is sand, gravel, and cement, is hauled on. The taxpayer would do well to examine material. If a standard grade of cement has been specified he need not worry further about it. The cement is no magic material, however, and the road or concrete will be no stronger than the sand and gravel which is mixed with the cement. The taxpayer will do well to examine the sand and gravel.

The sand should be clean, coarse, and well graded, or varying in size from fine beach sand to little pebbles about one-quarter inch in diameter. Coarse material should predominate and the sand as well as the gravel should be free from dirt, clay, vegetable matter, or any other foreign substance, because these substances will prevent the cement mortar from "bonding," or completely surrounding every particle of sand and gravel.

The gravel or hard crushed stone should range in size from one-quarter of an inch to an inch and a half in diameter. Soft limestone should not be used, although hard limestone can be used successfully. Many engineers do not permit the use of limestone in any form as a wearing surface, so that if one-course work has been decided upon gravel or hard crushed stone must be used.

Assuming that the materials are all right, that the foundation has been properly prepared and good drainage provided—all of which should be a matter of careful attention by the citizens living on the street—the next step is the moving to the scene of a large concrete mixer.

When the concrete is being mixed, or manufactured, one inspector should be standing in front of the loading "skip," or carrier, at the back of the machine. The other inspector should be in front of the machine to see that the concrete when coming out is of the proper consistency, that it is handled properly by the man who strikes off the concrete and by those who come afterwards and float or finish the surface.

The inspector at the back of the machine should see, first, that the specifications regarding the mixture are carried out. The standard mixture used on concrete road work is 1:2:3, which may be construed as one sack of cement (ninety-four pounds net), two parts, or two cubic feet, of coarse, clean sand up to one-fourth of an inch in size; and three parts, or three cubic feet, of clean, hard gravel or hard crushed stone from one-fourth inch to one inch in size.

Standards of Concrete Road Construction

Committee reports bearing on standard practice of concrete highway construction were offered at the National Conference on Concrete Road Building, held in Chicago Feb. 12 to 14. A resume of the conclusions and advice included in these reports is given herewith.

Aggregates

The committee on aggregates for concrete roads consisted of Sanford E. Thompson, consulting engineer; A. N. Talbot, president of the American Society for Testing Materials, and W. M. Kinney, assistant engineer, Universal Portland Cement Company. Stress was laid on the fact that the accuracy used in preparing other road-building materials should be applied in putting together concrete to be used for that purpose. To this end there are offered specifications for aggregates which, while in the main agreeing with the standard specifications now in force, nevertheless need to be studied by those who think that the incorporation of cement, sand and stone into concrete is a simple matter.

Actual laboratory tests are insisted upon for the fine aggregates, as it is difficult to distinguish by appearance between good and poor sands. Dry grains of sand are required to pass a $\frac{1}{4}$ -in. screen, while in the field a $\frac{3}{8}$ -in. mesh, or in some cases a $\frac{1}{4}$ -in. mesh, may be used. At least 2 ft. of top soil and loam should be removed before using sand, to obviate the danger of the presence of vegetable loam. In no case shall sand be accepted whose strength in 1:3 mortar at the age of 72 hours is not at least 80 per cent of the strength of standard Ottawa sand mortar in the same proportion.

For the stone the usual durable types are specified, the preferred shape being cubical. Shale, slate, shells and soft limestone must be rejected. The specified limits in size are $\frac{1}{8}$ in. and $1\frac{1}{2}$ in. for one-course pavements, and $\frac{3}{8}$ in. and 2 in. for two-course pavements. If bank gravel or crushed stone is used the sand or screenings should be separated and remixed in the proper proportions.

Letters from a large number of cities showed general satisfaction with the concrete pavement; adverse criticism usually came from cities where the specifications or description of the work indicates wrong practice. The report urged the following practice: If local conditions prevent following any one of these principal rules, adopt some other material than concrete for the pavement.

Subgrade

The committee on preparation and treatment of subgrade for concrete roads includes Ira O. Baker, professor of civil engineering, University of Illinois; A. R. Hirst, state highway engineer of Wisconsin, and A. N. Johnson, state highway engineer of Illinois. The report states that inasmuch as the strength of a plain concrete slab as a beam to carry a load over a low spot in the foundation is very slight, great care should be taken in preparing the subgrade. This is especially true if the concrete pavement is to be constructed upon an old roadbed, which is likely to be more compact in the center than at the sides. In this case it is not sufficient to roll the subgrade longitudinally, since the roller tends to balance upon the more compact central core.

In connection with drainage, if the soil is only

moderately retentive it will probably be sufficient to lay a line of ordinary farm tile along each side of the pavement. The tile should be at least 4 or 5 in. in diameter, should be laid $2\frac{1}{2}$ to 3 ft. below the surface and the drain should have sufficient fall to carry off any flow promptly. It is better to lay the tile outside of the ends of the slab than under it.

For soil more readily saturated it is recommended that a shallow longitudinal ditch be constructed just outside the edge of the slab, extending about 8 or 10 in. below the surface of the roadbed, and that this ditch be filled with coarse gravel or broken stone. Short transverse ditches should be dug across the road to the side ditch. In particularly retentive soil these transverse ditches should be placed not more than 50 ft. apart.

A set of specifications for subgrade are included, covering clearing and grubbing, excavating and embanking, and rolling the roadbed.

Maintenance Methods and Costs.

The committee on method and cost of repairing and maintaining concrete roads was composed of Edward N. Hines, J. S. McCullough and F. P. Wilson. The contribution of Mr. Hines, who is chairman of the board of county-road commissioners of Wayne County, Michigan, is here given practically in full. His opportunity to study the many miles of concrete roads in that district, some of which are in their fifth year of service, lends value to his remarks. Mr. Hines' remarks follow:

"Our work in Wayne County consists in filling the open expansion joint on the roads first built before the development and use of the armor joint, and in the filling with a mastic such longitudinal and transverse cracks as have developed.

"A crew consisting of seven men and a team, provided with a tar kettle, is utilized for the work. The foreman is paid \$5 a day, the team and driver \$5, the "tar man" \$3, two laborers \$2.50 each and two others \$2.25 each. The tools used consist of two wire bristle brooms, a wheelbarrow, a couple of shovels and a tar bucket with a round spout. Tarvia X is now used exclusively. A lighter grade was first tried out, but did not give such permanent results as the heavier grade. Two men are utilized to sweep all cracks clean with the wire brooms, after which the man with the tar kettle fills the cracks with the tar, which is heated to about 225 deg. Fahr. An excess of tar is poured in so that it extends an inch or so beyond the edge of the crack. It is then allowed to stand in the crack for a few minutes to prevent it from "bubbling" out in case the sand is wet. The sand, which should be dry and coarse, is spread with a shovel over the crack and into the tar, and the whole is left for traffic to iron out. The excess tar and sand is worn away rapidly, leaving a smooth, even surface, in passing over which no jolt is apparent. This method of repair prevents the edges of the concrete from spalling and chipping, and no water can get through to the subgrade to freeze and heave in cold weather.

"The work is preferably done on hot, dry days. It has been suggested that the better time to handle this work would be in the late fall when the cracks would be open the widest due to contraction, but the results we have secured in the summer months have been so satisfactory that we have not tried out the latter plan.

The small pit holes which are due simply to some foreign substance like clay, wood or some fragment of inferior rock which might chance to be a part of the aggregate, are treated in the same manner. As to the cost of this method, I desire to present a verbatim report of the members of the engineering staff, George A. Dingman and George F. Key:

COST OF REPAIRS TO WAYNE COUNTY ROADS FROM OCT. 1, 1912.
TO OCT. 1, 1913.

<i>Michigan Avenue, 17 Miles</i>					
Tar	20	bbl. at \$6.00	\$120.00		
Labor	10	days at 22.50	225.00		
Sand	18	yd. at 2.00	36.00	\$381.00	
<i>Grand River, 10 Miles</i>					
Tar	14	bbl. at 6.00	84.00		
Labor	6	days at 22.50	135.00		
Sand	8	yd. at 2.00	16.00	235.00	
<i>Gratiot, 1½ Miles</i>					
Tar	3	bbl. at 6.00	18.00		
Labor	2	days at 22.50	45.00		
Sand	4	yd. at 2.00	8.00	71.00	
<i>Jefferson, 1¾ Miles</i>					
Tar	6	bbl. at 6.00	36.00		
Labor	2	days at 22.50	45.00		
Sand	4	yd. at 2.00	8.00	89.00	
<i>Van Dyke, 2 1-3 Miles</i>					
Tar	5	bbl. at 6.00	30.00		
Labor	1½	days at 22.50	33.75		
Sand	4	yd. at 2.00	8.00	*83.00	
<i>Mount Elliott, 1½ Miles</i>					
Tar	3	bbl. at 6.00	18.00		
Labor	1½	days at 22.50	33.75		
Sand	4½	yd. at 2.00	9.00	60.75	
<i>River, 7 Miles</i>					
Tar	10	bbl. at 6.00	60.00		
Labor	5	days at 22.50	112.50		
Sand	12	yd. at 2.00	24.00	196.50	
<i>Eureka, 4¼ Miles</i>					
Tar	4	bbl. at 6.00	24.00		
Labor	2	days at 22.50	45.00		
Sand	4	yd. at 2.00	8.00	77.00	
<i>Wayne Road South, ½ Mile</i>					
Tar	1	bbl. at 6.00	6.00		
Labor	½	day at 22.50	11.25		
Sand	1½	yd. at 2.00	3.00	20.25	
<i>Woodward Avenue, 2¼ Miles</i>					
Tar	5	bbl. at 6.00	30.00		
Labor	2	days at 22.50	45.00		
Sand	6	yd. at 2.00	12.00	87.00	
51 miles*, total.....				\$1,300.50	

*The arithmetical discrepancy is a part of the report.—EDITOR.

"A percentage was added to cover engineers, inspectors and the depreciation of machinery and building and other "overhead" charges, making the total about \$1,450. The greater part of this mileage was treated for the first time. Once a year is often enough to go over the work and touch it up here and there, as we have found by experience that the bulk of the repairs previously made is intact.

"We have not had as good success in treating the entire surface of a road where the concrete from any cause has not stood the wear. One-half mile of concrete on Fort Road, built by Porath & Son, about 800 ft. on Grand River Road, built by the Owosso Construction Company, and 1¾ miles on Gratiot Road, out of the 80 odd miles of concrete road in Wayne County, are not up to the standard of the balance of the construction, and they have been surfaced with Dolarway, a special grade of Tarvia and Tarvia X. The surfaces of Fort and Gratiot Roads were both rough, having been built in cold weather, and opened for traffic before the concrete had thoroughly hardened. Fort Road was surfaced by the contractor before the board would accept the road and make the final payment. It carries a fairly heavy mixed traffic,

not as great, however, as either Grand River or Gratiot Roads. A special grade of Tarvia was used, furnished by the Barrett Manufacturing Company. The road was first swept by a street sweeper, which was followed by men with wire brooms. About ½ gal. of bitumen to the square yard was used, and the whole covered with coarse sand and rolled with a 10-ton roller. This repair was made early in the summer and was not touched in any manner for a period of two years. By this time it had scaled off in spots quite badly, and was gone over again in the summer of 1913, using Tarvia X and a washed roofing gravel about ¼ in. in size. We have no record of what the first coat was to the contractor, as we paid nothing for it.

"Gratiot Road was surfaced at cost to us by the Dolarway people in the spring of 1912. By the summer of 1913 about half of the original coating had scaled off, at which time we patched it up, using a special grade of Tarvia and Tarvia X. The Tarvia X has given the better result to date. Washed roofing gravel was used with the bitumen. This work was also rolled with a 10-ton roller. Gratiot Road carries an average traffic of over 1,000 vehicles a day. (On the last count made one week in August and one week in September the average was 1,210, of which 36 per cent was motor traffic and 64 per cent horse-drawn vehicles.) The surface of the road is wavy, and we have found it necessary to go over the work two or three times during the summer, touching up small spots here and there where it had scaled off. The cost of the work done by our board is in the neighborhood of 9 cents per square yard."

Shoulders.

The report on shoulders for concrete roads was submitted by Maj. W. W. Crosby, consulting engineer; E. A. Kingsley, former State highway engineer of Arkansas, and John H. Mullen, secretary of the Minnesota Roadmakers' Association. This report digresses somewhat in stating that a real economy would be obtained by increasing the widths of the road crusts so that nowhere would they be less than 18 ft. This would involve making the concrete itself wide enough to permit the passing of two lines of traffic without causing either to pass off the concrete on to the shoulder. Of course, for certain conditions the greatest economy would be found if the concrete surface was only made wide enough for one line of traffic.

In any event there should be used at the junction of the shoulder and the concrete roadway itself some material more durable than the natural earth. What material is chosen would be determined by such local conditions as the availability of material, the width of the road crust and the amount of traffic, but the wearing ability of the shoulder material should be above that required for the stresses to be expected at any point. A similar recommendation in the recent report to the American Society of Civil Engineers of the committee on bituminous materials for road construction was endorsed.

The report on mixing and placing materials for concrete roads was submitted by Paul D. Sargent, chief engineer of the State highway commission of Maine; Arthur H. Blanchard, professor of highway engineering at Columbia University, and C. W. Boynton, inspecting engineer of the Universal Portland Cement Company. An abstract follows:

In charging the skip a part or all of the coarse aggregate should be placed first, and the cement, fine aggregate, and remaining coarse aggregate, if any, on top of this. All the cement should be in the skip before the last of the aggregate is added. If charged in this manner there will be less tendency for the materials

TABLE 1—MIXING DATA OBSERVED IN PRACTICE

Mixer	R.p.m.	Mixing time
Smith	10	1½ min.
Koehring	18	40 to 45 sec.
(Unknown)	18	30 sec.
Foote	14	45 sec.
Eclipse	13	2 min.
Austin cube	16	50 to 55 sec.
Smith	11	2 min.
Chicago	24	30 sec.
Foote	18	25 sec.
Koehring	18	20 sec.
Austin cube	16	20 to 60 sec.
Koehring	32	15 sec.
Austin cube	16	10 sec.
Ransome	7	1 min.
Koehring	18	20 sec.

to stick in the skip when emptying and less loss of cement on windy days. A systematic method of loading the skip will also serve as a check on the right amount of material being placed each time.

No important operation is given less attention than the mixing of the concrete. Frequently the time the materials remain in the drum is governed only by the speed of the gang charging the skip. At times the batch mixer is operated practically as a continuous mixer, by fastening the discharge scoop or spout so that there is a constant flow of concrete from the mixer.

To insure thorough mixing the r.p.m. of the mixer and the time the complete batch, including water, remains in the mixer, should be specified. To specify only one is not sufficient, as shown by Table 1.

Upon inquiry of the manufacturers it was found that the drum r.p.m. varies for different makes and for different sizes of the same make.

Because of the shape and arrangement of the interior of the drum, the rate at which a given mixer is operated has a direct bearing upon the quality of the concrete; the drum should therefore be operated at approximately the speed at which the manufacturer claims the best results would be obtained.

All the materials in any one batch—including the water—should remain in the drum of the mixer at least 45 seconds before any of the concrete is discharged, and the drum should be completely emptied.

The practice on road work is to mix concrete entirely too wet. This causes a separation of the coarse materials from the mortar, resulting in stony pockets throughout the concrete. Where the concrete is mixed too wet, it is practically impossible to obtain and hold the required crown, and stony patches frequently appear on the surface after it has been finished, owing to the flow of water and mortar to the sides. In striking off and floating concrete mixed with an excess of water, it is also practically impossible to obtain a surface of the desired character, as the excess of water collects in and hides depressions and other inequalities in the surface, which cannot be corrected as they are not apparent until after the water has evaporated. The marked effect in the strength of concrete that a variation in the consistency produces is shown in the following table of results of tests made in the Sheffield Scientific School of Yale University by Charles J. Robinson. (See "Engineering News," Vol. 69, No. 21, May 22, 1913.)

TABLE 3—VARIATION IN STRENGTH OF CONCRETE.

Per cent of water	Length of test		
	7 days†	30 days*	60 days†
20	2052	2777	3194
22½	2173	3132	3305
25	2277	3278	3388
27½	2500	3516	3597
30	1722	2874	3166
32½	1413	2416	2666
35	1222	1977	2388
37½	1097	1819	2173
42½	652	1500	1888

*Average of two tests. †One test only.

In this test as a minimum enough water was taken to moisten the stone and sand, and then there was added 20 per cent (of the amount of the cement by weight) of water. Each subsequent mixture was increased by 2½ per cent of water. It was noted that the 42½ per cent mixture was about as wet as is used in the average wet mixture, though drier than some slushy mixes.

Just before placing concrete the sub-grade should be well sprinkled so that it will not absorb moisture from the concrete and should be checked by the engineer or inspector to make sure that the required thickness of concrete can be placed. Checking the subgrade may be done by the use of a straight edge or line, resting on, or stretched from the top of the side forms.

The excess of coarse material that accumulates in front of the strike-board should be uniformly distributed over the surface of the pavement, not left in narrow strips across the section or placed along transverse expansion joints. An ordinary garden rake will be found useful in distributing the material that accumulates in front of the strike-board. When the strike-board is within 2 ft. of an expansion joint the excess material that has accumulated in front of it should be removed with a shovel and deposited on the sub-grade in the next section. Special care should be taken to place good dense concrete along expansion joints, and all inequalities at the joints, including any small holes left after the removal of the installing device, should be filled with a mortar composed of one part cement and not more than two parts fine aggregate.

The strike-board should be cut to conform to the crown of the finished surface of the pavement and should be of sufficient strength and stiffness to show no deflection at the center when supported at the ends, nor a material bowing out of alignment when in use. It should be about 2 ft. longer than the width of the road, protected on the bottom edge with a metal facing and provided at each end with suitable handles.

For roads up to 12 ft. in width 2x6-in. planks, dressed on one side and both edges, spiked together, make a good strike-board, and for roads 12 to 20 ft. in width two 3x8-in.—or a 2x10 and a 3x10—spiked together, will be found satisfactory. The strike-board should not be so heavy that it cannot be easily handled by two men, and to reduce weight and increase stiffness, it is advisable for work over 20 ft. in width to use a strike-board composed of boards 2 or 3 in. thick, stiffened by trussing, rather than obtain the required stiffness by the use of heavier timbers.

Cost Data.

The committee on cost of constructing concrete roads included A. N. Johnson, State highway engineer of Illinois; Joseph Hyde Pratt, State engineer of North Carolina, and Albert Reichmann, president of the Western Society of Engineers.

Valuable work was performed by this committee in averaging the cost of work reported in the different States, confining the comparison to the one-course road. These data are presented in the following table:

The report also included diagrams showing the distribution of cost data on concrete roads recently built in various localities. The average distribution for seven Michigan roads built during 1909-1912 was as follows: Labor, 43 per cent; material, 57 per cent. Material was subdivided as follows: Aggregate, 29 per cent; cement, 22.7 per cent; miscellaneous supplies, 5.3 per cent. The average cost per square yard, excluding excavation, was \$1.62.

The corresponding distribution for Illinois construction in 1913 shows a charge of 38.5 per cent against labor and 61.5 per cent against material. Labor was

subdivided as follows: Unloading and hauling, 13.1 per cent; mixing and placing, 11.6 per cent; superintendence and miscellaneous labor, 7 per cent; shaping roadbed and trimming shoulders, 6.8 per cent. Materials was also subdivided, as follows: Cement, 31.7 per cent; aggregate, 25.2 per cent; expansion joints and miscellaneous, 4.6 per cent. The average cost per square yard, excluding excavation was 94.3 cents.

The cost data on eight sections of road in Wayne County, Michigan, constructed during 1912 and 1913 were as follows: Labor, 46 per cent, and materials, 54 per cent, divided as follows—cement, 19.9 per cent; aggregate, 27 per cent, and miscellaneous, 7.1 per cent. The average cost per square yard is not reported.

It will be seen that the average distribution for labor and materials is about that reported in the last example.

AVERAGE COST OF ONE-COURSE CONCRETE ROADS

State	Cost per square yard
Arizona	\$1.20
Arkansas	.90
California	1.17
Colorado	1.25
Connecticut	1.32
Delaware	1.61
Idaho	1.09
Illinois	1.01
Indiana	1.23
Iowa	1.11
Kansas	1.08
Maine	1.48
Maryland	1.21
Massachusetts	1.29
Michigan	1.27
Minnesota	1.05
Missouri	1.17
Montana	1.83
Nebraska	1.40
New Jersey	1.12
North Dakota	1.26
Ohio	1.22
Oklahoma	1.05
Oregon	1.39
Pennsylvania	1.16
Tennessee	1.20
Washington	1.31
West Virginia	1.32
Wisconsin	1.06
Average total	\$1.24
Weighted total average	\$1.19

CONCRETE SILOS PROOF AGAINST FIRE, CYCLONES AND LIGHTNING

There are plenty of insurance companies ready and willing to write policies against fire, lightning and tornadoes, but insurance costs are heavy. To put the year's feed for the dairy herd into a silo which any one of these elements can destroy is dangerous business. Concrete is unburnable. Lightning goes to ground through the reinforcing rods without harming the walls, and there are plenty of examples of concrete silos that have withstood cyclones without harm. The three illustrations accompanying this article indicate what you may expect if you build of concrete.

The first is a silo that stood next to a wood barn, and had a wood feed room and chute. There remain now only the concrete foundations of the barn, the footings of the inside wood columns and the silo, but these are practically as good as new and had there been feed in the silo at the time of the fire, it would not have been harmed. The hottest fire is unable to harm the walls or hurt the silage within a well made concrete silo. This was made with Polk-Genung-Polk

Co.'s forms and is an excellent example of good workmanship.

Lightning generally starts fires, but sometimes wrecks buildings without firing them. A concrete silo is absolutely safe from such injury. The second

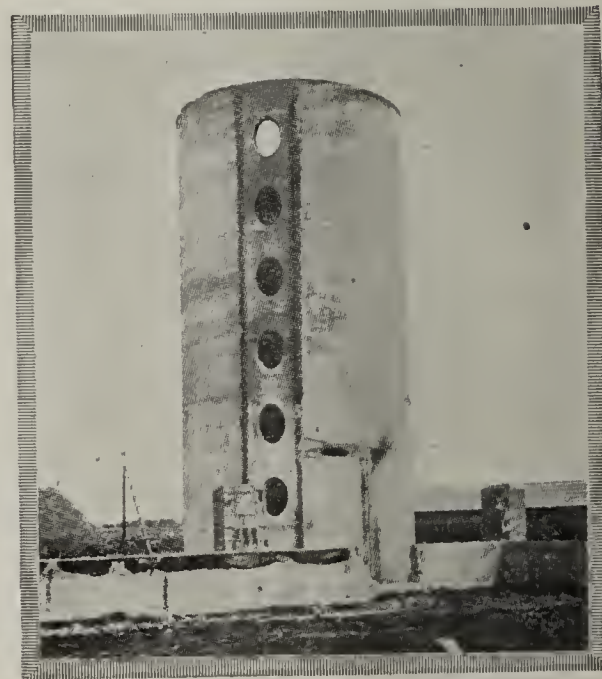


The Concrete Silo after the Cyclone.

illustration shows the silo of Wm. H. Jones, Jr., of New Lebanon, Indiana, which was struck by lightning late in 1913. The current seemed to follow the wire reinforcing around the silo, chipping out a few small pieces, but doing no real harm. The owner describes it as a 36x54-foot silo, built about eight years ago and still in perfect condition. He says, "Looks good for 8,000 years more." This silo was built with ordinary farm help, with the aid of a carpenter in erecting the form and scaffolding.

Eight years ago, when this silo was built, concrete workers were not as expert as now and the rough walls would be considered poor work today, but the concrete was made rich and the silo is perfectly suited for its work. Incidentally, it is one of the biggest ones in the United States, having a capacity of over 1,300 tons.

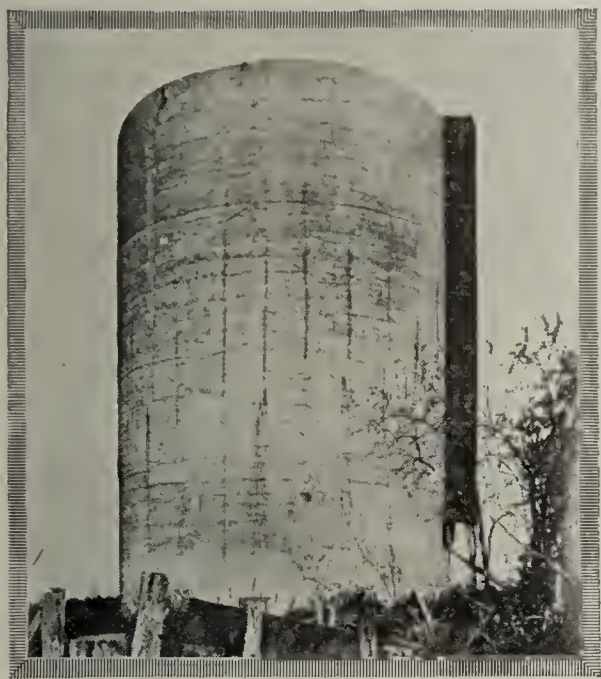
It is probable that thousands of silos are struck by lightning every summer, but the vertical reinforcement is almost perfect protection from lightning, as the electricity goes directly to the ground without harm.



The Concrete Silo after the Fire.

It is commonly thought that nothing can withstand a cyclone, but in July, 1913, a cyclone struck Frankfort, Kentucky, and 81 large barns in the county were blown down. Garrett C. Jones had a wooden barn and a concrete silo. The barn was scattered over a

radius of 100 yards, although a new structure. However, the 45-foot monolithic concrete silo still stands without any damage whatever. Had the silo been filled at the time of the cyclone, there would not have been a dollar's worth of loss. Other silos of lighter construction were blown down by hundreds in the county and only concrete or masonry silos stood up.



The effect of such an object lesson as this silo standing among the ruins has done a great deal to convince the farmers of Kentucky that concrete is the best material for their farm buildings. Following the fire a salesman of Polk-Genung-Polk Co., makers of silo forms, sold a considerable number in the cyclone district and the contractors have had all they could do in the last season with many contracts on their books for this year's business.

NEW BOOK—REINFORCED CONCRETE CONSTRUCTION

Professor Geo. A. Hool's new book on reinforced concrete construction, Volume I, is now for sale by the publishers, price \$2.50 net. Sent on receipt of price by Cement and Engineering News, 64 W. Randolph St., Chicago. 9½x6½ inches, cloth bound, 254 pages. Contains fundamental principles including numerous tables and diagrams to facilitate the calculation and design of reinforced concrete structures. This volume forms the first part of the regular course on Reinforced Concrete Construction offered by the Extension Division of the University of Wisconsin, and, in common with a number of other structural engineering courses offered, presupposes a knowledge of the elements of structures. It has been written primarily to meet the needs of those who desire to take up the study of this subject by correspondence, but the author sees no reason why a text of this nature may not be employed for other purposes.

The complete text for the course in Reinforced Concrete Construction is in three volumes; one on the fundamentals, one on the detailed design of retaining walls and buildings, and one on the detailed design of bridges and miscellaneous structures. The present volume on fundamentals omits, for simplicity, the flat-slab type of floor construction—a subject reserved for thorough treatment under the heading of concrete floors in Volume 2. The text is intended to be supplemented with such material as is suited to the special needs of the individual student.

REINFORCED CONCRETE BRIDGES OF LUTEN DESIGN

Cement & Engineering News wishes to acknowledge receipt of the very attractive and interesting catalog just issued by Daniel B. Luten of Indianapolis, Ind. It contains over 50 half tone illustrations of Luten design arches built throughout the country. The following information concerning the concrete arch and Mr. Luten was taken from pages 5 and 44 of the new catalog and may be of interest to our readers, viz.:

Daniel B. Luten, designing and consulting engineer, was born at Grand Rapids, Michigan, in 1869. Was graduated from University of Michigan in 1894 with the degree of Bachelor of Science in Civil Engineering. Was then appointed Instructor in Civil Engineering at University of Michigan, assistant to Prof. Chas. E. Greene, one of the foremost authorities on the elastic theory of arch analysis and author of Greene's Graphic Method of Truss and Arch Analysis. After one year resigned this position to become Instructor in Civil Engineering at Purdue University, Lafayette, Indiana, in charge of instruction in arch design, stereotomy, and theory of hydraulics.

Resigned from the Faculty of Purdue University in 1900 to practice engineering and after one year in general practice entered actively on the design and construction of reinforced concrete bridges. Since 1901 has followed this specialty exclusively and from 1900 to 1906 supervised the design and contracted and erected over five hundred concrete bridges; since 1906 has limited his engineering to design and supervision only and not including contracting or construction. During the past fourteen years has supervised the design of approximately 12,000 concrete bridges of which 6,000 have been erected, of spans from five to 150 feet each. The accompanying pages show approximately 50 examples of Luten Design arches.

Has conducted numerous experiments on arches and reinforced concrete and has published numerous articles in Engineering News, Engineering Record and other technical journals. These articles now total approximately one hundred and have been supplemented in recent years by upwards of fifty illustrated lectures delivered before engineering societies and students of technical schools.

Has an organized staff of eleven assistant engineers and thirty-one associate engineers located in all parts of the United States. Has made numerous improvements in methods of design and erection of concrete bridges and has been granted thirty-nine patents therefor by the United States Government.

Member of the Western Society of Engineers, Member of the American Society of Engineering Contractors, Member and Past-President of the Indiana Engineering Society, Member Illinois Society of Engineers and Surveyors, Member Iowa Engineering Society, Member Engineering Society of Wisconsin, Member American Concrete Institute, and Member American Highway Association.

Advantages of Concrete Bridges.

Concrete bridges are permanent improvements.

Concrete bridges require neither painting nor repairs.

Concrete bridges have no wooden floors that are periodically out of repair.

As time passes, traffic on our highways grows heavier; steel and wooden bridges grow weaker; concrete bridges grow stronger. To build a concrete bridge, then, is just plain common sense.

Concrete bridges are flood-proof and frost-proof, rust-proof and fire-proof. A concrete bridge once built, is built for all time.

A concrete bridge is the only bridge that grows stronger as it grows older.

Concrete arch bridges are readily adapted to soft foundations.

Concrete bridges are built with home labor and materials. The money expended for a concrete bridge returns directly to the tax-payers.

Are Permanent Bridges Economical?

A county with excellent credit and no indebtedness, but using all its income for current expenses, desires to build a small highway bridge of fifty-ft. span. The county borrows from a bank \$1,000 and buys a steel bridge with wooden floor. At intervals of five years the bridge is refloored at a cost of about \$100 for each renewal. At intervals of eight years the bridge is repainted at a cost of \$50 for each painting.

Now, at the end of twenty-five years, in spite of painting and floor renewals, the steel bridge is worn out and must be replaced with a new structure. The interest on the \$1,000 borrowed at the bank has amounted to \$60 each year on a six per cent basis and the \$1,000 still remains unpaid.

The county has then paid for the first twenty-five years the following amounts:

Interest on \$1,000 at \$60 per year.....	\$1,500
Reflooring every five years, four times...	400
Repainting every eight years, two times	100
	\$2,000

a total of \$2,000 which amounts to \$80 per year, and the \$1,000 originally borrowed still unpaid and must now be increased to \$2,000 or do without a bridge.

The county then borrows another \$1,000 and builds a new bridge of the same kind.

For the next twenty-five years the cost per year runs \$140 because of the interest on the additional \$1,000, and the county is in debt \$2,000. At the end of fifty years the county will be paying at the rate of \$200 per year and be in debt \$3,000. At the end of seventy-five years the county will be paying at the rate of \$260 a year and be in debt \$4,000. And at the end of one hundred years it will be paying at the rate of \$320 a year and be in debt \$5,000.

It takes no financier to see that the building of temporary steel or wooden bridges will lead to bankruptcy or to higher tax rates.

Suppose instead that a permanent concrete bridge had been erected costing nothing for repairs and repainting, but costing a third more than the steel bridge in first cost, the only charge to the county would have been \$80 for interest and an indebtedness of \$1,333.33, which would never need be increased for that bridge.

If money can be borrowed at a lower rate on a bond issue, say at four per cent, the showing is even more favorable for a concrete bridge, and the county can then afford to pay fifty per cent more for concrete.

The State of Kansas has passed a law that no steel bridge shall be built when a concrete bridge can be secured for one-third greater cost.

NATIONAL STONE COMPANY

The National Stone Company, Omaha, Neb., who have a large crushed stone plant at Louisville, Neb., advise us that they use a Marion steam shovel for stripping over burden in their quarry and they have two locomotives manufactured by the Vulcan Iron Works, Wilkes Barre, Pa., which give splendid service.

MODERN CONSTRUCTION WORK

Mr. James L. Stuart, contracting engineer, Pittsburgh, Pa., in a paper read at a meeting of the Cleveland Engineering Society, discourses as follows on business methods as applied to construction work:

"It has not been more than twenty years at most," he said, "since the construction of buildings was left entirely to practical men who had themselves worked up from positions as artisans or laborers to positions of leadership in constructional lines. Some of these leaders in the past were most talented and even brilliant, but they did not bring with them into the business, except in rare instances, the methods of the trained engineer or the progressive business man, their principal assets being nervous force, executive ability and practical knowledge of the building trades. However, as building construction became more complex and of greater magnitude, the necessity of trained men who understood the engineering problems and who appreciated the application of business methods necessary to bring 'order out of chaos' became more apparent, and now both engineering knowledge and modern business methods are most necessary to get proper results as to economy and quality in all of the larger undertakings.

"In order to successfully construct a building, it is necessary that one should anticipate each step in the progress of its developments and outline a complete system for its erection, including the various steps from the time the drawings are received from the engineer or architect until the building is turned over completed to its owner. The first step in such a process is to make a complete estimate of the cost of the structure from the drawings and specifications, including every item mentioned in the specifications or shown on the drawings. In addition to this, there are other small items which are not mentioned in the specifications, but which are necessarily a part of the cost of the building and should be included as such. Under the latter are such items as the cost of administration, liability insurance, temporary buildings, expediting, tools and machinery, and numerous smaller items. These estimates of cost were originally made up by the contractors themselves and were but approximations as compared with the present method of compiling them. In the latter method every advantage is taken of the prevailing market prices when the estimate is made, of the conditions of the labor market, the physical condition under which the work is to be done, and the season of the year. In a properly prepared estimate the unit prices should vary on each individual piece of work, whether figured at the same time or not.

Making Up a Time Schedule

"After the estimate has been made of the total cost of the building—and I think an estimate should be made of every building, whether the work is to be let on a lump sum contract, cost plus a fixed sum, or on a time and material basis—the next step is to make up a time schedule allowing fixed periods of time for the completion of each part of the building. This must be done most carefully, as on this schedule is based the dates of completion of the different contracts for material and the contracts with sub-contractors for furnishing such portions of the work as are not to be executed by the general contractor's force in the field. This time schedule is made after a thorough study of the drawings, the site of the new project, and a familiarity with the estimate, which, as I have said before, gives the quantities of the different kinds of material and assists in estimating the length of time required to complete the various stages of the work.

"A proper executive organization to do the field

work is most important. It is far better to have too much assistance in the field than too little. First, there must be a superintendent who possesses rare abilities as an executive, who understands drawings and specifications thoroughly, who has had wide experience in building work and who has a knowledge of the different trades so as to be able to anticipate far in advance of his requirements. Above all, he should be able to create in those working under him, including the workmen employed by his department, and foremen and workmen of the different sub-contractors, an enthusiasm in their work, a desire to see it grow steadily, and to do it in the most substantial manner possible. If the work is of sufficient magnitude, he should have an assistant superintendent, or possibly two or three of them, a large enough clerical force to do the timekeeping, and to keep an accurate cost record, and he should segregate the cost of the additional work which was not originally provided for. All of this work, if permitted to lag for even a day, becomes most complicated, and if not accurate, its value is entirely destroyed. In addition to this, it is the duty of one of the clerks to send to the main office each day an accurate and concise report of what has been done during the day, the state of the weather, temperature, etc. As the building nears completion, work in the main office lessens, and it is usually an excellent idea to have the man in charge of the particular job in the main office to get in actual touch with the building and to assist the superintendent in picking up the loose ends and in getting each trade completed as rapidly as the progress of the building will permit. This man (from the main office) is thoroughly familiar with each trade, knows just what changes have been made in the work, has a splendid knowledge as to how long it will take each trade to complete its work, knows the difficulties under which each has been laboring and can finish his 'following-up process' from the field more intelligently than if he were to remain at the main office.

"The cost of a piece of work is always of interest. The estimating department has access to the daily and weekly cost reports, which are compiled in the accounting department, and from these they can compare and report to the proper person whether or not the work is being done each day or each week within the amount allowed for the same in the original estimate. If the work is not being done within this cost, and if the unit prices vary considerably from day to day, an investigation is at once made at the building to ascertain the reason for such fluctuations, to advise the superintendent of the discrepancy and to see if ways and means can not be found to bring the cost within its proper allowance—the estimate having been based on the cost of similar work under the same conditions, the proper average should not vary greatly from the amount allowed in the estimate."

Mr. Stuart described at length their work in the rebuilding of a large Pittsburg manufactory, which had been destroyed by fire, and in the erection of the Statler Hotel, at Cleveland. In his concluding words after discussion, he said:

Prefers Lump Sum Basis

"If we can get contracts under reasonable competition, we much prefer to do work on the lump sum basis, as the work is then entirely in our hands, and whatever we can save by any unusual attention or ingenuity is ours. However, if there is a chance that the competition will not be fair, and we are after the job pretty hard, we are glad to take it on a commission basis. A great deal depends on conditions. If the contractor is thoroughly honest, and when I say 'thoroughly honest' I mean if he has a real con-

science, then it seems to me that a commission basis is the best on which to operate from the standpoint of the owner, because he gets exactly that for which he pays.

"When we take work on a commission basis, and we do a great deal of that work in Pittsburg, we make up an estimate of the actual cost of the work and tell the owner how much he is likely to expend. We do this for two reasons: One is that we do not want our organization to get into the habit of making any difference whether it is on a commission or a lump-sum basis. If you give the owner an estimate of his building, then it is everybody's purpose to keep within the estimate. The other reason is that we think it is only fair that the owner should know what the building is to cost, and we sometimes guarantee that the work will not exceed a certain maximum sum.

"The owners should be satisfied even though it may be a little more expensive to have the work done on a commission basis, as it saves them in other ways. For example, it gives the owner a chance to make changes and to have the work done in just the way he wishes, so as not to interfere with his business. Personally, I do not think it costs any more to do the work on a commission basis, especially if the contract covers several buildings or a long period of time. We now have three contracts on a commission basis which are yearly contracts; that is, unless they are canceled before the close of the year they carry over to the next year.

"I think the principal objection to percentage work is that the owners do not sufficiently trust the contractors. I know many honest contractors, but, just as in other business, there are some who are not honest.

"We sometimes let some of the work to sub-contractors on a commission basis, but never when the work is of such character that it must be prepared away from the building, such as mill work, steel work, ornamental iron, etc. We have done our own plastering work, but we did not find it very advantageous, because most sub-contractors look after the work themselves as foremen. Fireproofing, painting and other trades are usually sublet. Most people agree that to get some one who knows how to do it is worth the profit they pay to the contractor.

"It is essential that sub-contractors and all others connected with a piece of work shall take interest in facilitating the work. Little progress can be made unless every one is doing his part. We sometimes go so far as to stimulate interest among those furnishing the materials. For example, some one may be sent out to meet the superintendent of the brick plant, from whom the bricks were bought. In fact, our representative may meet the man who writes out the bills and also the man who loads the cars. To be more specific, during the construction of the Statler Hotel we had a man at the stone quarry who saw that the stone was shipped just as we needed it; he stayed there two or three months. The lower courses were shipped first, but even then we paid a large demurrage."

WATERPROOF CEMENT PATENT

The McCormick Waterproof Portland Cement Company, manufacturers of the Shamrock waterproof Portland cement, St. Louis, Mo., write us under date of April 22, 1914, as follows: "No infringement or other decree against the McCormick Waterproof Portland Cement Company is in force. Litigation between that company and the Medusa Company is now pending in the United States Circuit Court of Appeals, but the case has not been passed upon by that tribunal."

Notes on Sand, Stone and Gravel for Salt Water Cement

By Harrison S. Taft, Seattle, Washington

The success to be obtained by placing concrete structures in sea water depends upon, first, the possibility of using cement in salt water, and, second, an economical design. Without doubt a great many prominent engineers hesitate to recommend the placing of concrete structures in sea water more from a chemical point of view perhaps than from a structural one. If the material out of which the structure is to be built cannot be depended upon to maintain its integrity when exposed to the elements, the very best design will not solve the problem.

Therefore, the chemistry and manufacturing side of the cement industry becomes a question of prime and vital importance as regards cement to be used in sea water structures. The next question is that of impermeability; otherwise the concrete might slowly deteriorate under the action of the chemicals in sea water, since perhaps it is impossible to reduce such actions to a negative quantity. In freezing climates this question of impermeability becomes a very serious one, due to the destructive action of alternate freezing and thawing.

Cement.—The first and chief difficulty that has to be overcome in using concrete in sea water is "the peculiar chemical disintegrating action of the magnesium and other sulphate contents of ocean water upon the alumina compounds in the cement," followed "by the abrasive action of the water of the ever-restless sea" upon the chemically affected and softened concrete.

To overcome the chemical action of the sea water upon concrete the Germans have placed upon the market a brand of cement called "iron ore cement," wherein the alumina content of a cement is partly replaced for fluxing purposes by iron which is not affected deleteriously by the magnesium and other sulphates of the salt water; thus inoculating the concrete, as it were, against attack. The world-famed Teil Cement Works does not allow more than 2 per cent alumina and absolutely no free lime in the cement which they manufacture for use in concrete structures standing in sea water.

Another German product called Puzzolan-Portland Cement, especially devised for use in sea water, has been on the market some 16 to 18 years. This product is a mixture of Portland cement and a natural puzzolan (a volcanic ash), or of a Portland cement and an artificial puzzolan (blast furnace slag of a certain chemical composition), the mixture being 30 to 60 per cent puzzolan and 50 to 70 per cent Portland cement.

The chemical action in hardening results in a Puzzolan-Portland hydraulic cement invulnerable to sea water. Although the mixing can be done on the job, it is far preferable to pulverize the two ingredients together in the mill at the cement factory.

A set of extensive tests made by the German government shows higher strength for Puzzolan-Portland cement concrete both in tension and compression than for pure Portland cement concrete. It has also been demonstrated that the former resists salt water far better than the latter. From an economic point of view in producing resistance to the action of sea water a barrel of Puzzolan-Portland cement has been found to be equal to two barrels of pure Portland cement.

From information obtained in regard to these two German cement products, concrete made of them and placed in salt water has been giving the best and most satisfactory results. Thus a vast amount of salt water concrete construction is being carried on in Germany and other foreign countries, due no doubt to their overcoming the action between salt water and the cement.

Though there have been a number of disastrous disintegrations in using American Portland cements in salt water, on the whole American Portland cement seems to have worked quite satisfactorily in sea water.

Such cement "has the power of armoring itself against the action of the magnesium sulphates of the sea water by the formation on its exposed surfaces of a film of lime carbonate." This film appears to serve as an effective protection to the concrete structure in comparatively still waters, but where the waters are greatly agitated this film has no opportunity to form. Hence "the calcium hydrate set free by the decomposition incident to the hardening of the Portland cement is washed away," leaving the concrete structure unprotected against "further inroads of the deleterious chemicals contained in the sea water."

To reduce the question of the chemistry of sea water cement to a more technical form, Mr. J. M. O'Hara, in a report to the Southern Pacific Railway, states: "The magnesium sulphate present in sea water acts upon the calcium hydrate of the cement, forming calcium sulphate, and further, this calcium sulphate combines with the alumina of the cement, forming calcium sulpho-aluminate, which last compound gives rise to the swelling and cracking of the concrete."

Mr. O'Hara also states that though it may seem that a cement in which the alumina has been replaced by iron is desirable, it would be impracticable, however, to replace all the alumina in a cement by iron oxide, as "a product resulting from the burning of ferric oxide and calcium carbonate does not possess hydraulic properties." He further says that whereas it seems to be universally accepted by engineers and others that a dense concrete is impermeable to sea water, the results of tests made by him do not seem to bear out this theory, unless the cement used has the inherent qualities to resist the disintegrating action of the sea water.

In discussing the subject of mass concrete in block form for breakwater purposes, William Matthews, a prominent English engineer, says:

"In a tideway, where mass concrete is used, it is of the utmost importance that the relative sizes and proportions of the aggregate should be such as to produce an absolutely watertight material. The infiltration of sea water into green or unset concrete and its subsequent exudation due to tidal action causes the magnesium salts in the sea water to withdraw a portion of the lime of the cement in the form of calcium salts, leaving a deposit of magnesia in its place. It is this magnesia, derived from sea water, either alone or mixed with lime from the cement, which constitutes the white substance deposited in the interstices of porous concrete between high and low water. Concrete so affected possesses but little strength and its failure is only a question of time.

As the result of his research upon the use of cement for sea water purposes, the eminent Dutch chemist, V. I. P. de Blocq van Kuffeler, Hoorn, in a paper read

* From Metallurgical and Chemical Engineering, January, 1914.

before International Association for Testing Materials, New York, September, 1912, states "that the decomposition of the concrete is caused by the salts contained in sea water; the sulphates are the most to be feared owing to their action on the unstable compounds of lime which are formed during the very long period taken by the cement for hardening. Evidently it is during the first part of this period that the action of sea water is the most detrimental, i. e., when the compounds are least stable. Actual experience has confirmed this theory."

He also says that "when such material as trass or puzzolanes are added to the cement, one part of the lime forms compounds with silicates, the other compounds mentioned becoming more stable and the influence of sea water is less to be feared;" that "fine trass increases the impermeability of the mortar;" and "if the concrete has been hardened in a damp atmosphere the influence of the trass is still more marked."

Irrespective of the brand, a cement to be successfully used in salt water must be of the very best quality, of a fine pulverization, and thoroughly analyzed and tested for its chemical properties. Every means should be taken to avoid too much alumina in a cement that is to be used in salt water. The per cent of alumina should be low, that of silica high. The cement should also be as free as possible from gypsum.

A cement of the slow hardening order should be avoided. Distinction between "setting" and "hardening" of cement should be kept in mind. A slow setting but quick hardening cement is the proper kind to use in salt water.

Not only must the cement manufacturers provide the engineer and the contractor with a cement of the proper chemical constituents, but the concrete made from said cement must be dense in order to fulfill all the requirements of a salt water concrete. This apparently is what the Germans have been doing, and it explains why they are able to get such excellent results in concrete work in Germany as well as in other foreign countries. It is an exceedingly important question for domestic cement manufacturers to consider.

As considerable stress has been laid above on the German method of manufacturing cement for sea water purposes it is fitting to still further consider what Herr Blocq van Kuffeler says upon the question of using cement in concrete placed in salt water. He states that the following points should be most strictly adhered to in using concrete in salt water:

(a) Artificial (slow-setting Portland) cement of first-class quality and hardening very uniformly should be used to the exclusion of all others.

(b) The mixing of the material and the ramming of the concrete in strong and tight casings must be performed with the greatest possible care.

(c) The use of trass (or puzzolanes) is recommended.

(d) The concrete must be compact and the composition of the mortar should not be below 1 part cement, $\frac{1}{2}$ trass and 3 sand, or 1 part cement, $1\frac{1}{2}$ sand.

(e) Allowing the concrete to set in a damp atmosphere before placing "in situ" greatly increases its resistance to attack by sea water and is recommended where possible. When the concrete is exposed to the infiltrations of sea water immediately after manufacturing its composition should be richer.

In conclusion he says a carefully considered composition, most careful manufacture, the use of excellent cement with trass (or puzzolan) and hardening in a

damp atmosphere are the most efficient means of satisfactorily ensuring the preservation of reinforced concrete in maritime works.

Laboratory or Similar Tests.—For several years past the United States government has been carrying on a set of tests at Atlantic City and elsewhere to determine the exact fact as regards the use of cement in sea water. A preliminary report of these tests has recently been issued by the government. Although three years is a comparatively short time for determining the absolute facts under actual conditions, the results of these tests so far published seem to indicate that the success of using concrete in sea water depends in a large degree upon careful and proper working of the material rather than upon the special brand of the cement itself. It is true that some cement works better than others in sea water, those with a low percentage of alumina giving the most satisfactory results, but with an impermeable structure as the prime factor in all cases.

Although these government tests will no doubt in time give the concrete engineer the absolute facts as regards the situation, the engineers of this country already have the actual experience of some 18 years of foreign practice by which to guide themselves. No doubt the final results of these United States government tests will simply substantiate what has already been learned regarding the use of cement in sea water by foreign chemists, viz., an impermeable mass with a low per cent of alumina in the cement used.

In the early part of 1909 twenty-four test pieces were made of concrete and hung from one of the wharves at the Charlestown Navy Yard, Boston Harbor. These test pieces were 16 feet long, 16 inches square and made with a core for part of their length so as to provide a means of determining their permeability. Several different kinds of cement were used in making these pieces and the concrete mixed in various proportions; some of the pieces being made dense, others porous. These pieces were hung from the pier in such a way as to have their lower ends always in water, while the tops were seldom submerged. At the end of the first two years of immersion one of these test pieces showed marked signs of deterioration, while others were in good condition. Later reports go to substantiate the truism mentioned above, since the pieces made of a porous nature have deteriorated somewhat while those of a dense nature are in the same perfect condition as the day they were made.

Though these laboratory tests will go a long way in revealing the true facts and actual conditions it is necessary to guard against in the use of cement in sea water, "it must ever be kept in mind that the phenomena, both physical and chemical, in the sea cannot be reproduced exactly in laboratories on land." Consequently laboratory tests will never give the real truths of using cement, and hence concrete, in sea water as will actual experience. Thus the actual experience of foreign engineers in the use of concrete in sea water structures and the modes pursued by them are far more valuable to the American engineer than any short time test made in this country.

Admitting that laboratory tests are absolutely necessary and that the world cannot get along without them, such tests must be considered hand in hand with actual experience and as supplementary thereto. The fact that local conditions and local material will seriously alter cases brings home to the engineer the truth that he must not judge foreign experience by home

conditions, and vice versa, until the actual conditions covering each are known and is used as the complement of the other.

Waterproofing Compounds.—In view of the claims made by waterproofing experts as respects the excellency of their product, it is proper to quote from an article entitled "Test of Water-Proofing Material," U. S. Bureau of Standards, No. 3, August 22, 1911: "Portland cement mortar and concrete can be made practically water-tight or impermeable (as defined below) to any hydrostatic head up to 40 feet, without the use of any so-called 'integral' waterproofing material; but in order to obtain such impermeable mortar or concrete, considerable care should be exercised in selecting good material and aggregate, and proportioning them in such a manner as to obtain a dense mixture. The consistency of the mixture should be wet enough so that it can be puddled, the particles flowing into position without tamping. The mixture should be well spaded against the forms when placed so as to avoid a formation of pockets on the surface."

"The addition of so-called 'integral' waterproofing compounds will not compensate for lean mixtures, nor for poor material, nor for poor workmanship in the fabrication of the concrete. Since in practice the inert integral compounds (acting simply as void filling material or in the nature of a lubricating material) are added in such small quantities, they have little or no effect on the permeability of the concrete. If the same care is taken to make the concrete impermeable, without the addition of waterproofing material, as is ordinarily taken when waterproofing materials are added, an impermeable concrete can be obtained."

In connection with this part of the subject it may not be out of place to speak of "oiled concrete" for waterproofing certain classes of concrete structures. It is of such recent development that sufficient opportunity has not been given to determine its real merits for universal waterproofing purposes especially as regard concrete structures standing in sea water. So far as known there are no records "of any such tests ever having been made and some chemists have positively stated that it will be impossible to make oiled concrete a success for sea water purposes."

On the other hand, I. Hiroi, a civil engineer of Japan, has stated: "Of more than 12,000 concrete blocks of all sizes and of different compositions, used by the writer in harbor works during the past ten years, there has not been the slightest indication of failure. On the contrary, the protection given by coatings of animal, vegetable and mineral origin to the surfaces of the blocks has rendered them almost impregnable against the incessant action of the sea. The protection thus afforded by nature, which would render a comparatively weak artificial stone, when properly made, as lasting as the natural stone used as its ingredient, is unknown in laboratory experiments."

Sand, Gravel, Stone.—The sand used in concrete placed in sea water must be clean, sharp and free from all foreign material. The stone must also be clean and sound. Gravel, if used, must likewise be clean and of proper size. The chemical composition and mineral structure of the stone, sand and gravel for use in proposed sea water concrete structures, should be known absolutely beyond all doubt. Since it is of great importance that concrete used in sea water should have the maximum density, the mechanical composition of sand and gravel should be known and modified, if necessary, by adding screened material.

For the same reason that an igneous rock or ma-

terial is far better in the construction of a fireproof concrete structure, it is absolutely necessary in salt water concrete to use aggregates that will not disintegrate or fail when exposed to the elements of the salt water and the action of the sea.

Mr. John R. Freeman has called the attention of engineers to the fact that "here and there are banks of sand and gravel which, upon ordinary inspection, appear ideally perfect for making mortar and concrete, but which are nevertheless dangerous in the extreme, and all because of some ultra-microscopic content, probably similar to tannic acid (in a colloidal film around the sand grain), which works in some mysterious way to prevent the union between the cement and the sand grains."

Mr. Freeman cites an occasion where he found at the site of a proposed structure what promised to be a most economical resource in a shape of excellent sand and gravel; but upon being tested some of the samples of 1:3 mix, six days in water, hardly maintained their integrity while being placed in the clamps and before any load was applied. The cement was of a brand that had given excellent results with other aggregates.

E. E. Free, an investigator, engaged upon physical and chemical investigations for the Bureau of Soils, has noticed analogous phenomena in studying the relative fertility of different soils. Mr. Free states that:

"In popular terms the situation can perhaps best be explained by considering that an extremely thin film of a complex form of tannic acid surrounds each grain of the troublesome sand and prevents its attachment to the cement. These complex organic acids have a strong tendency to spread themselves thinly and strongly adherent over the outside of the siliceous material. The reason why one particular brand of cement is able to break through this filmy barrier so as to get a firm grip upon the sand grain is because of its containing a small quantity of some form of alkali that unites with this acid film or somehow changes its colloidal state."

It is admitted that these defective sands are the exception rather than the rule. Though some engineers and contractors may think the whole investigation a highly interesting laboratory amusement, of no value whatsoever to practically construction, the fact remains that there are sands whose availability for concrete aggregate cannot be predicted under any of the ordinary methods now in vogue, and that ever so often one of these sands gets into a structure to its detriment and perhaps failure if the structure stands in sea water. Therefore the sand and stone should be tested as carefully as the cement for salt water purposes.

Of equal importance is the utmost care that must be taken in mixing and placing the concrete, in order to obtain an impermeable mass throughout. Superintendents and concrete foremen should also be careful to see that injurious acids do not get into the sand, gravel and stone of concrete to be placed in sea water by the working force urinating upon the material. Great care should likewise be taken to exclude from all material entering into the manufacture of concrete such things as scraps from lunches, tobacco and spittle of those chewing tobacco. It is known that an amount of sugar, even as small as $\frac{1}{4}$ per cent will entirely prevent a batch of cement from hardening. Since the extract from chewing tobacco contains sugar or glucose, any such extract that enters into the concrete will prevent the cement from settling. There are other organic compounds whose presence in the concrete will have a marked effect on the hardening of the

cement, and the utmost means should be taken to exclude such detrimental material from all concrete to be placed in sea water.

Mixture.—In connection with the concrete dock work of the Thames River the practice seems to have been to use "a gravel of moderate size combined with two-thirds of its bulk of sand mixed with one part of cement to every two parts of sand," viz., 1:2:3 mixture. It is stated that with such a mixture there will be no fear of the results if the concrete is properly mixed and handled. The concrete is also given a grout coating after it has set and hardened.

In building concrete breakwaters in Holland it has been found that mass concrete blocks made of 1 part Portland cement, $\frac{1}{2}$ part trass (the trass being a Puzolan which is found near Andernach on the Rhine), 3 parts sand and 5 parts Rhine gravel, enabled the blocks to resist the corroding action of the sea water. Of more recent date they have been using a cement-trass-concrete of 1 part cement, 1-3 part trass, 2 parts sand and 3 2-3 parts gravel.

In Germany a mixture of 1 part cement, $\frac{1}{2}$ part trass, 3 parts sand, 4 parts gravel, is very often used.

During recent years a very rich mixture, viz., 1:1 $\frac{1}{2}$:3, has been used in nearly all the important sea water concrete structures built in England and France.

In the harbor development of Otaru, Japan, a proportion of 1 part cement to 2 parts sand for the mortar gave superior results; the average concrete mixture used being "1 cement, 2 sand, 2 gravel and 2 broken stone, before the tuff was put in, the ratio equivalent by weight of the cement to the tuff being, 1 cement to $\frac{1}{2}$ tuff." By volume this combination reduces to: 1.0 cement; 0.8 tuff; 3.2 sand; 6.4 ballast.

In the Netherlands Portland cement concrete with the addition of trass has been used almost exclusively. Though Herr Blocq van Kuffeler recommends a mortar of 1 part cement, $\frac{1}{2}$ part trass and 3 parts sand mixture for sea water structures, he states that concrete of the above composition will remain in a perfect state of preservation "provided it has been hardened in a damp atmosphere before placing in situ, but is apt to give disappointment if the concrete is exposed to the infiltration of the sea water immediately following manufacture." Under the latter conditions he recommends a richer composition—at least 1 part cement, $\frac{1}{2}$ part trass, 2 $\frac{1}{2}$ parts sand. When no trass is used he says a mixture of 1 part cement, 1 $\frac{1}{2}$ parts sand should be used. He also says that whereas mortars of 1 cement, 1 $\frac{1}{2}$ sand and of 1 cement, 1 $\frac{1}{2}$ trass, 3 sand can be used with safety in marine concrete work, the latter will create a saving in cost of considerable extent. It is also of great importance that the cement and the trass should be thoroughly mixed before the sand is added.

As respects the use of salt water in the manufacture of concrete, the same eminent chemist states that since the amount of salts introduced into concrete by diffusion when the concrete is exposed to sea water is vastly in excess of any salts that might be introduced into the concrete "by the small quantity of water used in its manufacture—the use of salt water in the making of concrete is in all probability prejudicial to only a slight extent."

As in ordinary reinforcement work, when the reinforcement is complicated, a smaller size gravel should be used with their homogeneity increased, a size of not over .116 cubic inch being recommended by a leading authority for marine reinforced concrete.

Mr. I. W. Sandeman, in his paper upon "Action of Salt Water Upon Concrete," states that for salt water

purposes the maximum proportion of the sand in the mortar must not be more than twice that of the cement, and the mortar must exceed the voids in the aggregate. The exact grade of the sand mixed with the cement plays an important part in obtaining impermeable concrete, a hard, coarse sand giving the best results. It was the knowledge of this important point and a thorough investigation of it that enabled the noted Italian engineer, Com. Luigi Luiggi, to construct a dry dock at Bahia Blanca, in 1902, that resulted in a perfectly watertight job. The utmost care was taken in the construction of this dock, with special attention to the bonding of old concrete to the new.

As respects the advantages of using crushed stone over gravel, Mr. Staniford, chief engineer of the New York Dock and Ferry Department, states that his department does not find gravel a suitable material to use in mass concrete when subject to the action of the sea water, and that the broken, hard trap rock, so commonly used in New York City and vicinity, gives far better results in such kinds of concrete than are obtained with gravel. From the author's own experience with broken stone and gravel, he prefers stone, especially if it is trap rock.

Conclusion.—In the final analysis, the successful use of cement in concrete structures standing in sea water boils down to the use of an impermeable concrete made of a cement low in alumina and otherwise suitable for salt water purposes. The former is the problem of the concrete and construction engineer; the latter the problem of the chemist and cement manufacturer. To obtain an impermeable concrete a very rich mixture must be used, the exact proportion between the finer and coarser material being dependent upon the per cent of voids.

If possible the concrete should be hardened in a damp atmosphere in order to assist the chemical reaction of setting before being placed in situ, or before being subject to the action of the sea water, especially so if the sections are small.

The mixing and placing should be closely watched and done with the greatest care, far more so than in the ordinary building work, in order to ensure that each particle of the sand and coarser material is well covered with cement and mortar respectively. A concrete of a medium or plastic consistency will ensure far better results than a wet or dry mixture.

"In the Netherlands experience has furnished conclusive examples as a guide for future construction, with a sufficient degree of safety, as to justify the further application of reinforced concrete in marine structures, which after all are only the work of mortals and not destined to last for eternity."

TEN THOUSAND CONCRETE HOMES

Charles Ettinger, jeweler, 656 Euclid avenue, Cleveland, O., writes us as follows: "I have a brother-in-law interested in the purchasing of materials in the United States, for the building of ten thousand concrete homes in the city of Buenos Aires. These homes are to be built, principally, for Government employees. They have a special concession from the Government to receive all their material free of duty. Hence I am trying to get posted and in touch as to whom I should write for the information of best prices on such materials used in the construction of the houses in question, viz.: Re-enforcing material for concrete floors, cement, floor tiles, stairs, waterproofing material, expanded metal, hand pump for water, galvanized reservoir for water, gutters, galvanized water pipes, iron gates, fence, etc., etc."

REINFORCED CONCRETE BINS FOR GRAIN ELEVATOR

There has just been completed for the Great Western Milling Company at their mills, 917 South Alameda St., Los Angeles, Calif., a grain elevator that marks a radical change in the construction of this type of structure in the Southwest. Heretofore it has been customary to build these elevators or grain bins out of wood or sheet steel but with the advent of reinforced concrete, it has become common practice throughout the country to use this material for the building of these structures. The elevator mentioned is, however, the first instance of the use of reinforced concrete for this purpose in this section and will probably result in others adopting the same material for this class of work in the future.

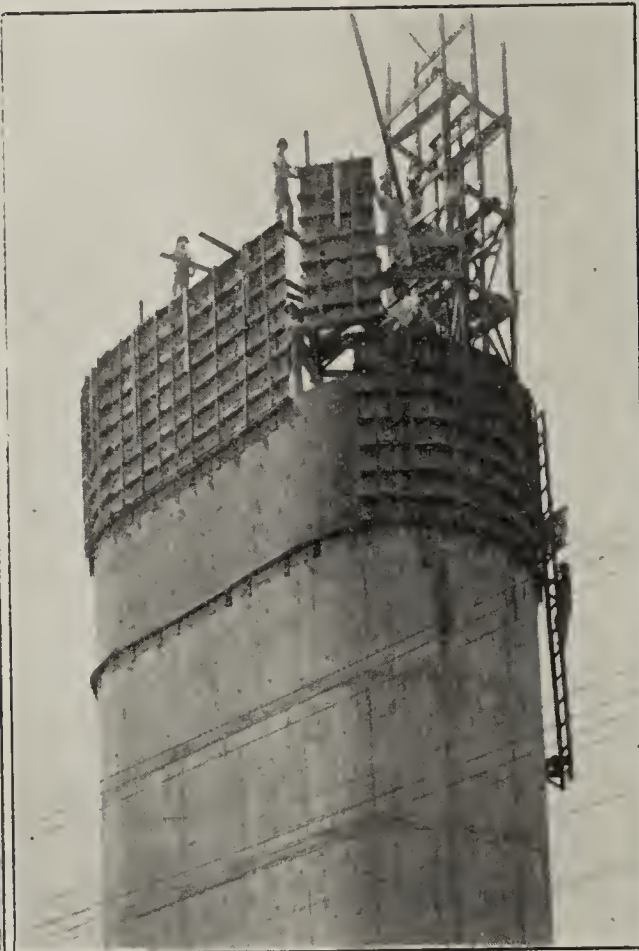
The accompanying drawings will give a very good idea of the plan of this grain elevator, it being similar to the type in general use elsewhere.

shown (in section "B-B") forms the bottom of the bins and is supported on basement or foundation walls and a center pier. These foundation walls are 12-ins. thick reinforced on both sides with horizontal and vertical steel. The central pier is formed of a series of interlaced hooped columns as shown in section. In the center of each bin is a circular opening 3 ft. 4 ins. in diameter for the accommodation of the iron gates used to draw off the grain. A sand fill or lean concrete mixture with a substantial wearing surface of concrete in the shape of a hopper is placed in the bottom of the bins surrounding this opening.

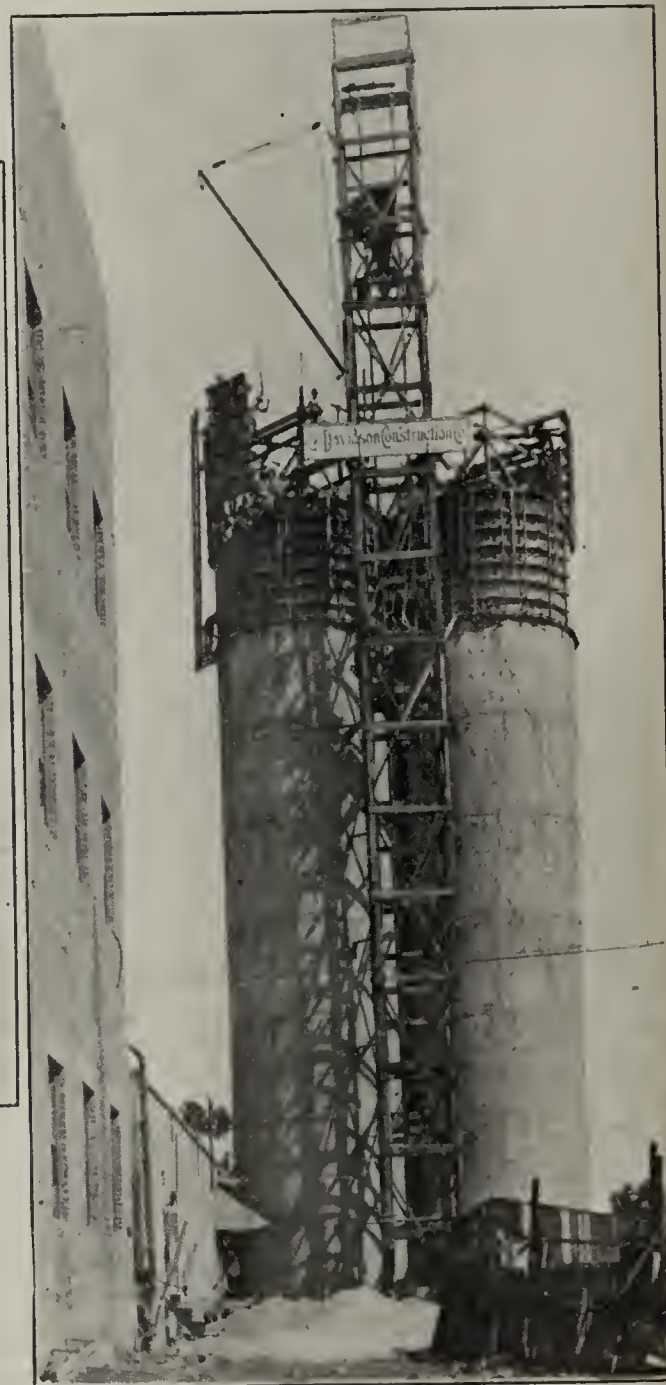
The space underneath the bins is designed to house the conveyor machinery used in handling the grain, as all lifting or transporting of the grain is done by either screw or belt conveyors. The foundation of the elevator consists of a flat slab 23 ft. 6 in. x 41 ft. 6 in. x 3 ft. 6 in. reinforced to properly distribute the superimposed load and secure uniform ground pressure. On



Completed Reinforced Concrete Grain Elevator for Great Western Milling Co., comprising first unit of two circular bins. Photograph taken from east side, showing flat wall forming a third small triangular bin. Mayberry & Parker, engineer; Davidson Construction Co., contractors.



Raising the Form Panels.



Grain Elevator Bins Under Construction Showing Skip Tower Boom and Forms Being Raised.

This particular structure consists of two circular bins 17 ft. 0 in. in diameter and 85 ft. 0 in. deep, so placed as to have a common wall for a portion of their circumference. A small triangular bin is formed by a tangent wall on one side while short pieces of steel are left sticking out of the walls on the opposite side for the tying in of future bins when needed. The outside walls of the bins are 8-ins. thick reinforced with horizontal and vertical steel on both sides throughout their entire height.

A flat slab 2 ft. 0 in. thick reinforced both ways, as

top of the bin and extending over one-half of each bin is the conveyor house, also of reinforced concrete. This house and the balance of the bins are roofed over with a concrete slab. The conveyor house is reached by an iron ladder on the exterior east wall. There are also ladders on the inside walls so that the bins may be cleaned.

Channel irons are bolted to the side walls at opposite points of the circular bins to anchor wooden cribbing in such a manner as to divide the bins into four equal sectors. This made the design of the structure

far more complicated than would be the case if a series of smaller circular or rectangular bins of equivalent area had been used, on account of the various conditions arising from different combinations of full and empty bins. The design of circular bins is fairly simple and determinate resulting generally in direct stresses, whereas the conditions arising from the use of these diaphragm walls made the problem very complex and somewhat indeterminate, introducing additional compound and reverse stresses. This necessitated the use of more than 25 per cent additional steel in the bin walls.

All reinforcement was medium square twisted and round steel. The exterior walls of the bins are left in the rough but have been painted with one coat of waterproofing and two coats of white lead and zinc paint. The bins have a capacity of about 35,000 bushels, weighing approximately 1,050 tons.

The aggregate used was composed of one part Riverside cement, $2\frac{1}{4}$ parts best river gravel (none being used that did not pass through $\frac{3}{4}$ -in. mesh), and $2\frac{3}{4}$ parts crushed rock. This mixture was found to give the best results and formed a dense, rich mixture. The excavation for the foundation revealed a splendid bottom of gravel and it was found unnecessary to put in other foundation work than that originally designed to carry the structure.

From the foundation slab to the top the walls of the bins were built up in units of 8 ft. in height, the interior and exterior forms being tied together with wire. The forms were composed of eight panels built of one-inch planks held together with 2x4-in. timbers. Only one set of exterior and interior forms was utilized, the concrete being given one week to set before the forms were released and raised for the next unit of construction. While the concrete was attaining its set the workmen were employed in bending steel and preparing for the next unit, or on other work.

The mixer, 13 cu. ft. capacity, was located in a pit near the base of the skip tower, the concrete being delivered direct into the skip from the mixer. The skip tower was located on the west side of the bins. The concrete was conveyed from the skip through metal troughs to the place where it was needed on the work. Platforms for the workmen were carried inside the bins on cribbing built up as the work progressed in height. The skip tower also supported the boom which was required for raising the form panels, the timbers for the cribbing, the reinforcing steel, platforms, and such other material as was needed, from the ground to the working platform. The Fulton hoist was operated by a 20 h. p. motor. The boom was operated by a hand winch.

The handling of the grain is done entirely by machinery after it is released from the sacks in which it arrives, into the hopper of the conveyor system. It passes through a cleaner before it is allowed to pass into the bins. When needed in the mill it is drawn from the bottom of the bins and elevated to the top by a screw conveyor, whence it passes by gravity through an 8-in. steel pipe having a clear span of 110 ft.

The elevator bins were engineered by Mayberry & Parker and were built under contract by the Davidson Construction Co., both of Los Angeles.—[Southwest Contractor and Builder.]

CONCRETE RESERVOIR

The new reservoir recently built by the city of Weiser, Idaho, is of reinforced concrete, rectangular in shape, with buttresses on the outside. This reservoir is 60 feet square and 18 feet to the water-line, the water being forced above the high water line and allowed to spill over so as aerate the water; a check valve being

provided to allow the water to flow back into the mains when the pump is not working. This reservoir has 740 cu. yds. of concrete and in it are 80,000 lbs. of twisted steel rods from $\frac{1}{2}$ inch to 1 inch square; 3 per cent of Medusa compound was mixed with the cement and a mixture made in which the voids in the gravel and sand were exceeded by cement by 5 per cent, making an impervious structure. The intention at first was to make a continuous pour of the concrete but in placing it during cold weather we found that it set up so slowly that one day's pour knit to the last one so as to make perfect bond. At first a little seepage, about 20 drops per minute, appeared at the outlet of the drainage system, but at the end of 60 days this had stopped entirely.

WHY NOT USE MORE CEMENT?

Considerations That Bear on the Insurance of Durable and Satisfactory Concrete Work

No subject has attracted greater attention from engineers interested in concrete construction during the past two or three years, than the question of the durability of concrete. For at least a generation it has been universally believed by the engineering profession that good concrete, properly made with sound cement, produced an artificial stone which was at least as durable on exposure to the weather as a sound natural stone. The fact that a very large amount of concrete laid during the past ten years and exposed to the weather and to percolation, in retaining walls and elsewhere, is now showing unmistakable signs of great deterioration, gives engineers much anxiety.

Whatever theories may be held as to the effect of the quality of cement made by different mills and different processes upon such deterioration, there will be general agreement upon the proposition that if concrete is to be exposed to the weather, the less porous it can be made the better. Other troubles which have been experienced with concrete may likewise be traced to the porosity of the material. We may refer especially to the failures which have taken place in some dry-docks where sea water percolated through the concrete and gradually weakened it, and also to the well-known difficulties with sea walls of concrete between high and low tide in climates of heavy frost where the freezing of the water in the pores of the concrete between tides brings about rapid deterioration.

A vast amount of discussion has gone on concerning methods of waterproofing concrete by filling its pores with various materials, and millions of dollars have been expended during the last decade upon waterproofing materials. But a committee of engineers on the subject of waterproofing has gone on record with the declaration that about the best waterproofing for such cases is to make the concrete rich in cement. In structural work, too, a committee of engineers has expressed the opinion that cement is a cheaper reinforcing material for concrete compression members than steel, up to the limit of strength which can be obtained by merely enriching the mixture.

Taking all these things into consideration, it occurs to us to raise the question whether engineers and contractors in general are not using too little cement in mixing concrete. There seems good reason to believe, that we have been to a large extent continuing along in the old ruts of habit that were formed when cement was a high-priced material, costing \$3 a barrel or more; and that at the present prices of cement prevailing in most localities, the added strength and durability to be gained by using a much richer concrete would be well worth all it would cost. Engineers have been content to accept lean mixtures of concrete, because such mixtures, when thoroughly made

and set under ideal conditions of the laboratory, show a very satisfactory strength. Among contractors, builders, and workmen, too, the idea is strongly embedded, that because even a very lean mixture of good cement with sand and stone sets up hard and firm, it is therefore all right to economize in cement and make a little go a long way.

We believe that engineers, at least, will do well to sit down and reflect whether the use of lean mixtures of concrete in many places is not a case of saving at the spigot and wasting at the bung hole. Do most engineers and contractors fully realize how very little more it costs per cubic yard to make a very rich concrete instead of a good concrete? In order to demonstrate this we have compiled the accompanying table showing the actual cost of the materials required for making one cubic yard of concrete of three different grades, namely, a 1:3:5, a 1:2:4, and a 1:1½:3 mixture.

Quantities and Cost of Material in One Cubic Yard of Rammed Concrete

Stone containing 45% voids; cement at \$1.00 per bbl. of 4 cu. ft.; sand and stone each at \$1 per cu. yd. Data from Taylor and Thompson's "Concrete."

	Cement	Sand	Stone	Concrete
Proportion by parts.....	1	3	5	
Amount required for 1 cu. yd..	1.16 bbl.	0.52 cu. yd.	0.86 cu. yd.	
Cost per cu. yd. for.....	\$1.39	\$0.52	\$0.86	\$2.77
Proportions by parts.....	1	2	4	
Amount required for 1 cu. yd..	1.51 bbl.	0.45 cu. yd.	0.89 cu. yd.	
Cost per cu. yd. for.....	\$1.81	\$0.45	\$0.89	\$3.15
Proportions by parts.....	1	1½	3	
Amount required for 1 cu. yd..	1.91 bbl.	0.42 cu. yd.	0.85 cu. yd.	
Cost per cu. yd. for.....	\$2.29	\$0.42	\$0.85	\$3.56

We presume most engineers will agree that a 1:3:5 mixture is to be considered a first-class concrete. It is doubtful whether as much as 5 per cent of the mass concrete used by engineers is mixed with any larger proportion of cement. The 1:2:4 mixture is at present limited to reinforced-concrete work, and to other places where an engineer desires a specially dense and firm concrete for waterproofness or other reasons. The use of a 1:1½:3 mixture is limited, as far as we recall, to concrete paving specifications, and some few users of reinforced concrete columns.

What we wish to show is the small effect which the increased richness of the concrete has upon its cost per cubic yard; and the difference in cost between the different grades of concrete will be affected very slightly by variations in the cost of sand and stone. As the figures in the table show, the additional cost of a cubic yard of 1:2:4 concrete as compared with a 1:3:5 concrete, is only 38c. To transform a 1:3:5 concrete into the very rich 1:1½:3 mixture, costs only 79c per cu. yd. for the additional cement.

It may be said that where the 1:3:5 mixtures gives a material sufficiently strong, it is adding needless expense to put in the extra cement. This may be true where the material is put in as a foundation footing, for example, and is not exposed to deteriorating influences nor subjected to extraordinary loading. But where the structure is a bridge through which water from the roadway will continually be percolating, or where the structure is a retaining wall whose face might suffer from the weather and the percolating ground water—in these and numerous other places—it would seem worth while to spend from 40 to 80c per cubic yard additional for the sake of obtaining a solid, dense, water-resisting material instead of a more or less porous one.

When one considers that the average contract price of concrete per cubic yard in a finished work ranges from \$4 to \$5 up to \$10 or \$12 and even \$20 or more on work involving difficult form construction, one can appreciate all the better how well worth while it is to spend the small amount which the above table indicates is necessary to transform the ordinary con-

crete to the most, dense, hard, and waterproof mixture that can be obtained.

A very large amount of concrete is laid in positions where it is paid for at a price per square yard instead of per cubic yard. Sidewalks, street and roadway pavement, and cellar floors may be taken as examples. If we assume a 6-in. layer, then the added cost per square yard of 1:1½:3 mixture over a 1:3:5 mixture is only 13c per square yard. Taking into consideration that the added strength of the richer mixture gives greater freedom from cracking as well as greater water-proofness and durability, and will usually permit the use of one-course instead of two-course construction, with a material saving in labor, the case for the rich mixture becomes all the stronger.

It is true that mixtures of concrete materials may be made in the laboratory which will show a very great density with mixtures made only rich enough to fill the voids and give a small surplus over. But concrete construction is not a laboratory process by any means. Even with the greatest care taken by the engineer and the most thorough supervision of the work, the finished concrete will not be the uniform product which is turned out in the cement-testing laboratory. We do not by any means suggest that wasteful use of cement is to be resorted to in order to escape the results of careless work by the concrete gangs; but the engineer's business is to produce the best results at the lowest cost; and if we can save labor by spending money for cement, as in using one-course instead of two-course work on paving, for example, there may be a gain in reduced cost as well as in better construction.

Some may argue that it is yet to be demonstrated that a richer and denser concrete would prove more desirable than the ordinary mixtures. It is undeniable that much of the concrete laid twenty years or more ago with the rather meager proportions then prevailing is today perfectly sound. Where failure of greater or less extent has occurred, however, the concrete is so often found to be porous that it is reasonable to believe a denser mixture would have had a longer life.

It will be evident, of course, that the figures we have given above are to be modified in any particular case according to variations in the cost of cement from that above assumed of \$1.20 per bbl. The enormous productive capacity of the cement mills, however, is pretty fair assurance that the engineer can rely on generally moderate prices for cement prevailing in the future. He will do well to use the material liberally in his work, and not risk its durability by any attempt to save a trifling amount in first cost.—Engineering News.

SAND-LIME BRICK

W. M. Burchfield, general manager of the Rochester Composite Brick Company, Rochester, N. Y., is very optimistic of conditions in the sand-lime brick field for the year 1914. Mr. Burchfield states that out of an increase of over 6,000,000 sand-lime brick manufactured in the state of New York in 1912, his concern furnished 4,500,000, or about 75 per cent. He believes that had financial conditions of 1913 been as good as 1912, the Rochester Composite Brick Company would have turned out at least 15,000,000. However, the production was as large as the previous year. In the city of Rochester sand-lime brick is meeting with the approval of all the leading architects and contractors, who are rapidly learning of its qualities and the great number of uses to which it may be put.

LARGEST REINFORCED CONCRETE GRAIN ELEVATOR IN THE WORLD

The marine traffic of the port of Montreal is second only to that of the port of New York among all the ocean ports of North America. An important portion of the export traffic from Montreal is grain, which is, for the greater part, wheat from the Western provinces of Canada.

On account of the inadequate export grain handling equipment in Montreal, the John S. Metcalf Co., Construction Engineers, erected for the Harbor Commissioners a grain elevator of the highest class, providing a rapid and efficient plant for the unloading of railway cars and inland vessels, of sufficient storage capacity so that merchants could hold grain at the exporting point when it became advantageous to do so, and to eliminate the direct transfer of inland cargoes to ocean vessels.

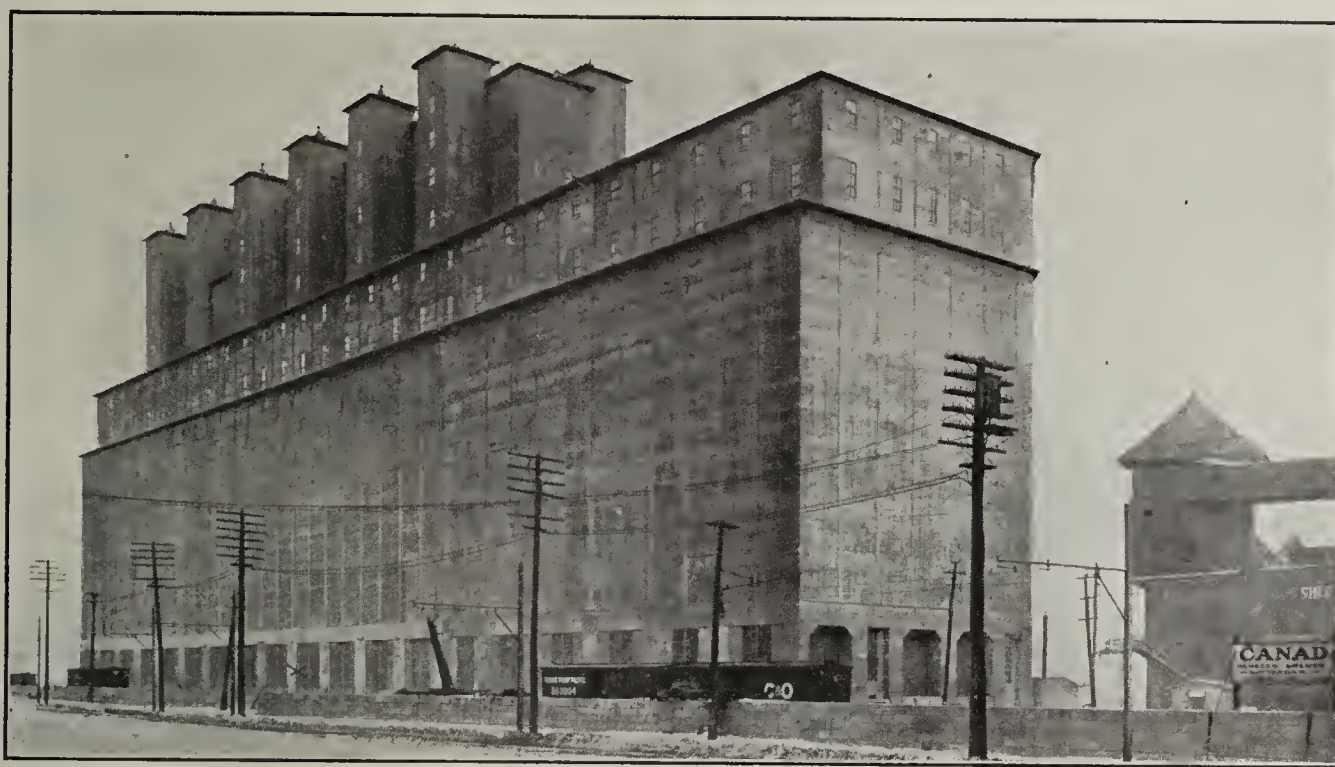
The entire structure, including first story bins and the cupola above the bins, is of concrete. Even in

It is stated that the automatic scales, fourteen in number, are the largest automatic scales ever constructed, and to build them it was necessary for the manufacturers to erect a complete elevator for the purpose of testing each machine before shipment.

This is the largest reinforced concrete grain elevator in the world, and brings the handling and storage capacity of the harbor in excess of any other North American ocean port. The Medusa Waterproofing for this immense monument of cement work was furnished by the Stinson-Reeb Builders' Supply Co., Ltd., Montreal, Que.

CONCRETE POLES

Although reinforced concrete poles have been the subject of experiment from time to time for a great many years, it is comparatively recently, says a writer in the *Electrical World*, that they have been employed or even seriously considered. The high and increas-



Largest Reinforced Concrete Elevator in the world. 30,000 lbs. Medusa waterproofing used to make the work impervious to water and dampness.

the cupola, columns, beams, walls, floors and roof are of this material, making it absolutely fire-proof, and 30,000 lbs. Medusa Waterproofing were used to make the work impervious to water and dampness.

The elevator, including storage addition, is 456' 8" long by 100' wide and 220' 9" high to the top of the leg towers, and has a total capacity of 2,622,000 bushels. Four railroad tracks extend through the entire elevator, the shipping conveyor galleries are 1½ miles long, and ordinarily the elevator will receive 240 cars in 10 hours. The concrete bins are 86 ft. deep and bin walls are in general 8 in. thick, while the bin capacities range from 6,800 bushels to 14,300 bushels and the total number of bins is 278, exclusive of shipping bins. The total shipping capacity, starting with the shipping bins full, will be 90,000 bushels hourly for ten hours.

In the construction of this elevator 48,000 cubic yards of concrete and 5,100 tons of steel were used. The machinery will be run by electricity, for which 64 motors have been installed, totaling 4,000 horse power, and 13 telephones will be used in elevator and conveyor galleries.

A marine tower for unloading boats was also constructed, the maximum hourly capacity of which is 40,000 bushels, and a reinforced concrete building was provided for a grain dryer with a capacity of 5,000 bushels per day.

ing cost of wooden poles, their comparatively short life, with consequent prospective renewal at greater expense, as well as the public demand for the beautification of city streets, render the consideration of concrete pole construction desirable for modern overhead systems.

Quite a number of successful installations of concrete poles have been made during the past five or six years on this continent and in Europe. The largest pole installation at present is that of 25,000 poles installed in connection with the municipal street lighting and general light and power distribution system of the Toronto hydro-electric system in Toronto, Canada.

The appearance of an overhead installation can be greatly improved by employing a pole of neat and uniform construction, such as is obtainable by the use of concrete. With a suitable lighting system and arrangement of overhead wiring, a pleasing and, in fact, ornamental effect can be secured at a cost substantially the same as when wooden poles are employed and with a prospective saving in maintenance expense. This would appear to be of especial interest to the smaller cities and residence districts of large cities, where the demand for underground construction is based mainly on esthetic considerations, but where such construction is not justified by the revenue to be obtained.

LOADING SAND AND GRAVEL

We are handing you herewith half-tone illustrating one of our Class E Lidgerwood-Crawford drag line excavators owned by the Southern Sand & Gravel Co. of Fredericksburg, Va., whose gravel pit is located at Massaponax, Va., a short distance from Fredericksburg, writes the Lidgerwood Manufacturing Company, Fisher Bldg., Chicago.

We believe it will be interesting to your readers if you will publish the method by which this gravel is handled after reaching the washing plant, inasmuch as through a peculiarity of the gravel it is required that it be washed twice after which it is a very fine product.

The excavator illustrated herewith is operated by steam power, the machinery on it being the very latest design,—the bucket machinery being built to give the maximum power required for the operation of the bucket and the swinging machinery designed to give speed and accuracy in swinging. This excavator is equipped with a 60 ft. boom and operates a 3 cu. yd. bucket. The raw material is dug and de-

HYDRATED LIME IN CONCRETE

There is no question as to the favorable influence exerted by a small proportion of hydrated lime in giving plasticity to cement mortars and concrete mixtures, facilitating the working of the mass, the flow of the concrete and the tendency towards fewer voids and a denser mixture. Its consequent tendency towards waterproofing is also well known.

In regard to the question of strength, cement mortars are, of course, at least three or four times as strong, both in tension and in compression, as hydrated lime mortars, and the substitution of hydrated lime for a small portion of the cement would naturally work towards slightly less strength, were there no compensating advantages either in the physical condition, as pertaining to the density of the mass, or of some reaction between the hydrated lime and the cement, writes Bernard Enright, Director, Eastern Testing Laboratories, Allentown, Pa., in "Concrete-Cement Age."



posited into gondola cars by the excavator and this material is hauled to the Washing Plant by standard gauge locomotive.

At the time of installation of this excavator it was estimated that the required capacity would be approximately 1,500 cu. yds. per day of 10 hours, including delays attributable to cars not being in a position at all times for loading by this excavator.

In connection with the above excavator, beg to advise that it runs on maple skids and rollers, the width of its base being approximately 18 feet, the excavator weighing approximately 93 tons.

We understand that this excavator has been running all winter and has been handling frozen material.

GRAVEL WASHER

A new improvement in the shape of a No. 1 washer with screen attached has been devised by the Stocker Concrete Material Washer Co., of Highland, Ill. This equipment does the washing and screening in one operation and is said to have proven satisfactory after repeated tests.

The fact that experiments show that the increase in strength noted in mortars to which a small proportion of hydrated lime has been added is generally with mixtures with a high percentage of voids, while cement and graded sand mixtures with a minimum of voids show but little effect or even a slight diminution of strength on the substitution of a small proportion of hydrated lime, seems to indicate that in general the favorable effect of such addition lies principally in the increased density of the mass.

Hydrated lime, however, also acts as a retarder on quick setting cement. It is a well known fact that "breaking the set" in handling concrete made with cement which tends to set before the mass is placed in position, very materially weakens the resulting structure. In a case such as this, the addition of hydrated lime, by retarding the set so that the mass can be placed before the initial setting of the cement takes place, will result in a structure of at least normal strength, as opposed to the former abnormally weak result.

DATES FIXED FOR THE ANNUAL AMERICAN GOOD ROADS CONGRESS AND EXPOSITION

The American Road Builders' Association will, as recently announced, hold its next annual congress and exposition in Chicago, Ill. Before, however, deciding the question, the Executive Committee made a very careful and impartial canvass of the claims of the leading cities of the United States. The selection of Chicago was made because of that city's unsurpassed transportation facilities—which permit delegates from every part of the United States to reach it easily and quickly—and because of its unequalled facilities for the holding of a great national convention and exhibition.

After a most thorough investigation of the relative merits of the Coliseum and the International Amphitheater, the latter was decided upon as being better suited to the requirements. The dates fixed upon for the meeting are Monday, Tuesday, Wednesday and Thursday, December 14, 15, 16 and 17, these dates being selected as the only ones available in that month which would give ample time for the installation of exhibits.

The International Amphitheater is situated on South Halsted St., and extends from 42nd St. to 43rd St. It is within twenty minutes ride from the downtown or "Loop" district of Chicago and may be reached by six surface car lines and the Stock Yards branch of the elevated railway. The facilities afforded for accommodating, under one roof, both the sessions of the convention and the exposition of machinery, materials and methods are ideal in practically every respect. There are available between 75,000 and 100,000 square feet of exhibition space all on one level in the main building. The floors are of concrete with no basement underneath and will carry almost any load thus making possible the display of the largest and heaviest machinery. A railroad track runs directly into the building, so that if desired, exhibitors may have shipments sent from any point outside of Chicago directly to the Amphitheater. The building has practically unlimited electric power, which will enable exhibitors to show their machinery in operation. The hall in which the sessions of the convention will be held is on the second floor, where machinery in operation and other noises from the exhibition will not interfere with the proceedings. The structure is well lighted and heated throughout.

While the plans for the Eleventh Annual Convention and the Sixth Good Roads Show have not, of course, been completely worked out at this early date, it can safely be said that the meeting will not only include the greatest exposition of machinery, materials and methods of road and street construction and maintenance ever made, but will also be the greatest meeting of men directly connected with the construction of roads ever held in the world. The programme will be so arranged as to bring together the leading authorities and experts on road building in the United States and Canada. It is also planned to make the exhibition of the greatest educational value, and to this end there will be introduced features which will be of very great interest and practical value to delegates and guests. The exhibits will include those of the different states and of leading cities, besides many engineering and scientific schools and colleges.

The officials of the Association having the matter in hand express themselves as highly gratified by the enthusiasm for the meeting evinced by leading citizens and public officials of Chicago and by the state highway officials, not only of Illinois, but of other states and especially those near Illinois.

CONCRETE POLES WITHSTAND STORM.

The extreme strength of the reinforced concrete telegraph pole has been demonstrated upon more than one occasion during violent storms, to which poles of the wooden type readily succumb. The most severe test ever inflicted upon them occurred during the recent blizzard, from which they emerged intact. Perhaps the most striking example of their extreme durability as exemplified in this storm was in the case of the telegraph line of the Pennsylvania Railroad Company, where a large number of reinforced concrete telegraph poles were exposed to the storm which swept over the Hackensack meadows in the vicinity of the west entrance of the Pennsylvania tunnels leading into New York City. The company had erected many of these poles in recognition of their durable and storm-proof properties. As is well known, the storm center was in and about New York City, and so violent was the wind, which reached a velocity of 70 to 80 miles an hour, and so great the accumulation of snow and ice, that New York was practically isolated for a time, at least so far as above-ground telegraphic communication with Philadelphia was concerned. The company's telegraph line was out of commission for a long time and many of the wooden poles were broken down by the wind and their burden of snow and ice. In no case, however, did a reinforced concrete pole collapse. So severe was the stress that the wooden cross-arms upon some of these poles were broken, but the poles themselves remained intact. The absence of telegraphic communication cost the company many thousands of dollars, as trains were stalled and in some instances completely lost during the height of the storm. There was no way for the company to get into communication with the crews. It has been stated that had the entire line been constructed of reinforced concrete poles it would have saved the company a tremendous loss.

This is the record of reinforced concrete poles wherever they have been used. These poles are made of Portland cement concrete reinforced with steel rods to take care of tensile strains, and as concrete improves with age and exposure to the elements, the poles are constantly gaining in strength and durability. As stated above, they are not only time-proof, but keep in far better alignment than poles of the customary type. They do not rot as do wooden poles and never rust as in the case with steel poles. At the present high price of timber, concrete poles are not prohibitive in first cost, and considered as a long time investment are extremely economical. The Pennsylvania and other railroad companies are establishing their own manufacturing plants and it is likely that the next few years will witness a marked increase in the installation of concrete poles on all important lines.

STUCCO HOUSES

The North Western Expanded Metal Company has just issued an attractive 40-page booklet entitled "Practical Home-building," by Mr. C. O. Powell. It deals with the methods of construction of stucco houses, and with the use of the company's metal lath and expanded metal. The first half of the book deals with stucco house construction in general. Subsequent pages describe and illustrate stucco houses, showing photographs and sketches of the plans. Other pages deal with porch and porch floor construction and with "overcoating" old frame houses. The book may be obtained by sending 10 cents to cover postage and wrapping, to the Northwestern Expanded Metal Company, Old Colony building, Chicago, Ill. Mention Cement & Engineering News when writing.

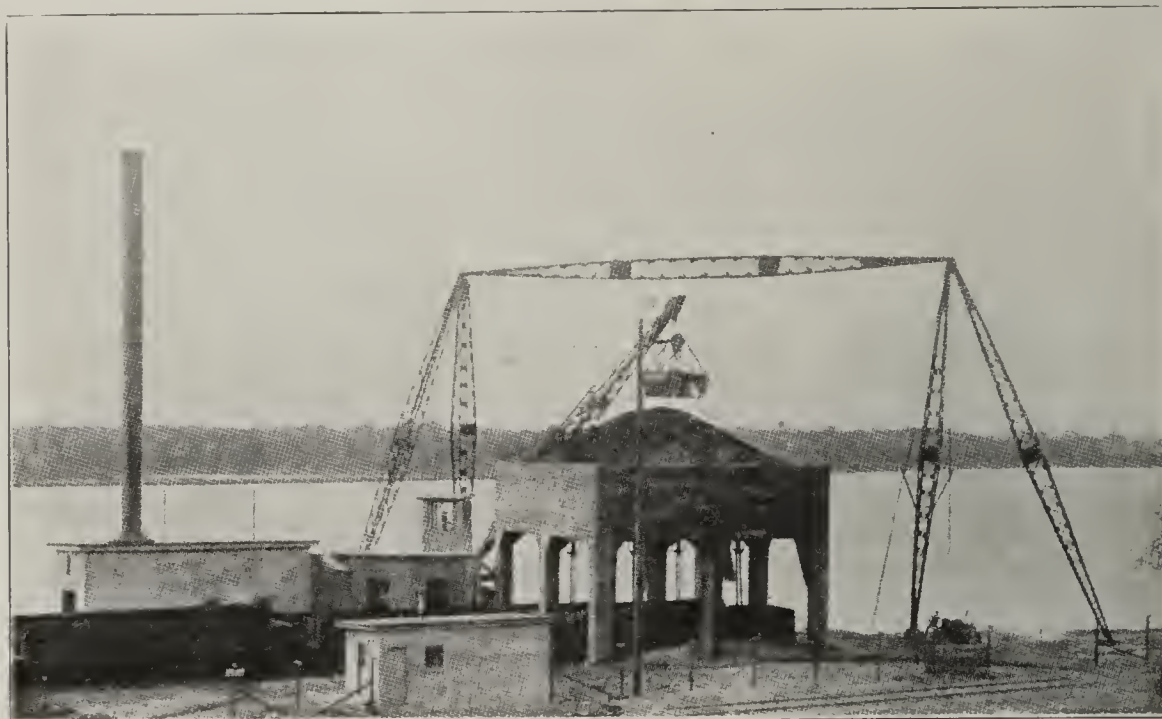
SAND BIN OF CONCRETE

At Alton, Illinois, is a plant for handling sand of some interest, belonging to the Mississippi Sand Co. It consists of a bin for the storage of sand, which is dredged from the river, elevated from scows by a clam-shell bucket into the bin and again chuted to cars for shipment.

The sand bin is $36\frac{1}{2}$ by 38 feet in plan by 30 feet above the railroad track and has a clearance for cars of 17 feet 8 inches to facilitate switching. The foundation is a mat of concrete, designed as an inverted flat slab, 41 feet square and 20 inches thick. This rests on an old fill consisting of earth and spalls of limestone from an old quarry. The bin stands on nine columns, each 2 feet 4 inches square, and consists of a flat 18-inch floor slab and 9-foot walls, heavily reinforced.

The plan also includes a boiler house and superintendent's office of frame, covered with metal lath and Portland cement stucco.

The support for the 10-ton derrick is a pier 40 feet high, built on bed rock. It is 16 feet square at the base, tapering to 9 feet square at the top, and is tied to the base of the bin by two reinforced concrete struts at an angle of 45 degrees, to counteract the overturning moment.



The operation of the plant is as follows: A centrifugal pump on a steamboat pumps sand from the Mississippi River bottom to a barge. This is towed to the plant and lifted to the bin by $2\frac{1}{2}$ -yard clam-shell buckets. From the bin it runs through twelve gates in the bottom to cars below, or through chutes in the side into wagons for local trade.

The sand bin was designed by Brussel & Viterbo, of St. Louis; the derrick, pier and engine foundations, by Morey Newgard & Co., of Chicago.

WATER-TIGHT CONCRETE

The report of the Committee No. 8, of the American Railway Engineering Association on masonry was presented by the chairman, Mr. G. H. Tinker, Cleveland, Ohio, bridge engineer of the New York, Chicago & St. Louis Ry., at their recent Convention in the Congress Hotel, Chicago, Ill. The following conclusions on water-tight concrete construction were offered for adoption:

(1) Water-tight concrete may be obtained by proper design, reinforcing the concrete against cracks due to expansion and contraction, using the proper proportions of cement and graded aggregates to secure

the filling of voids and employing proper workmanship and close supervision.

(2) Membrane waterproofing, of either asphalt or pure coaltar pitch in connection with felts and bur-laps, with proper number of layers, good materials and workmanship and good working conditions, is recommended as good practice for waterproofing masonry, concrete and bridge floors.

(3) Permanent and direct drainage of bridge floors is essential to secure good results in waterproofing.

(4) Integral methods of waterproofing concrete have given some good results. Special care is required to properly proportion the concrete, mix thoroughly and deposit properly so as to have the void-filling compounds do the required duty; if this is neglected, the value of the compounds is lost and their waterproofing effect destroyed. Careful tests should be made to ascertain the proper proportions and effectiveness of such compounds.

Integral compounds should be used with caution, ascertaining their chemical action on the concrete as well as their effect on its strength; as a general rule, integral compounds are not recommended, since the same results as to water-tightness can be obtained by adding a small percentage of cement and properly grading the aggregate.

(5) Surface coating, such as cement mortar, asphalt or bituminous mastic, if properly applied to masonry reinforced against cracks produced by settlement, expansion and contraction, may be successfully used for waterproofing arches, abutments, retaining walls, reservoirs and similar structures; for important work under high pressure of water these cannot be recommended for all conditions.

(6) Surface brush coatings, such as oil paints and varnishes, are not considered reliable or lasting for waterproofing of masonry.

As the result of a discussion by Mr. Maurice Curn, wherein a number of objections were raised against Conclusion 2, that conclusion was withdrawn.

The following conclusions in reference to disintegration of concrete and corrosion of reinforced metal were offered and adopted:

(1) Concrete to be exposed to the action of sea water or alkali waters or gases containing sulphur, or in which reinforcing metal is embedded, should be dense, rich in Portland cement and allowed to harden under favorable conditions before such exposure.

(2) Concrete to be in contact with alkali waters should be made with aggregates inert to the alkalis in the water.

(3) Cinders should not be used for concrete in which reinforcing metal is embedded.

(4) Reinforcing metal should not be painted, but should be thoroughly covered and protected with concrete when in place.

THE DE LA VERGNE OIL ENGINE, TYPE "FH"

This most economical type of oil engine has now entered upon its fourth year of service, and during that time over 200 of these engines, aggregating more than 20,000 horsepower, have been furnished to customers. These engines are running most satisfactorily, utilizing the heaviest and cheapest grades of fuel and saving large sums for their owners. Many of them have already saved more than double the amount expended on their purchase and installation.

Nine of the purchasers of these engines have already placed with us repeat orders for engines of the same type. Of these, three customers have given us two orders each, aggregating four engines for each customer; one customer has given us three orders aggregating seven engines; one customer has favored us with four orders aggregating eighteen engines; and one customer has placed with us no less than eight successive orders, aggregating forty-two engines in all. This, we believe, is the best possible demonstration of the satisfactory performance of the "De La Vergne" oil engine, type "FH," writes the De La Vergne Machine Company of New York City.

As constructed at first, this engine was designed to run on the heavier grades of paraffine fuel then on the market; but when the heavy asphaltic oils of the West put in an appearance, it was found practicable to utilize them also. Today many of these engines are running continuously and successfully on Mexican and California products containing more than 20 per cent of asphalt; and for months past the shop engines of the De La Vergne Machine Company have been operated on ordinary refuse water-gas tar, a product which formerly had no value whatever except in so far as it might be utilized as fuel under the boilers of the gas works which produced it.

Cycle of Operation

The type "FH" engine is single-acting and operates on the well-known four-stroke cycle, also described as the "Otto" or "Four Cycle." To complete this cycle, four strokes of the piston or two revolutions of the crank are required. The first outward stroke is known as the "suction stroke," during which the charge of air is drawn into the cylinder. This is followed by the return or "compression stroke," during which this air is compressed into the combustion chamber. At the completion of the "compression stroke" the highly atomized charge of fuel, propelled by compressed air, is instantaneously injected into the same chamber, forming a combustible mixture, the ignition of which takes place at once. Then follows the second outward, or "working stroke," during which the heat of combustion is converted into energy; and the cycle is complete by the second return of "scavenging stroke," during which the burnt gases are expelled from the cylinder.

Compression

At the beginning of the return stroke of the piston the air-valve is closed and the air thus confined in the cylinder is forced into the small combustion chamber at its rear end, and there compressed to about 300 pounds per square inch. This compression of the air heats it to a high temperature, and it is heated still further by contact with the hot walls of the vaporizer D, to be described later on.

Fuel Injection

The fuel is preferably stored in an underground tank outside of the power-house building, from which it is

raised by a small rotary pump driven by the engine, to a little standpipe located near the engine base. The action of the pump keeps the standpipe full of oil ready for use, the surplus flowing back to the main tank. From the standpipe the oil is withdrawn by the oil pump E and delivered at a high pressure to the spray valve F, whence it is propelled by compressed air in a highly atomized state into the combustion chamber.

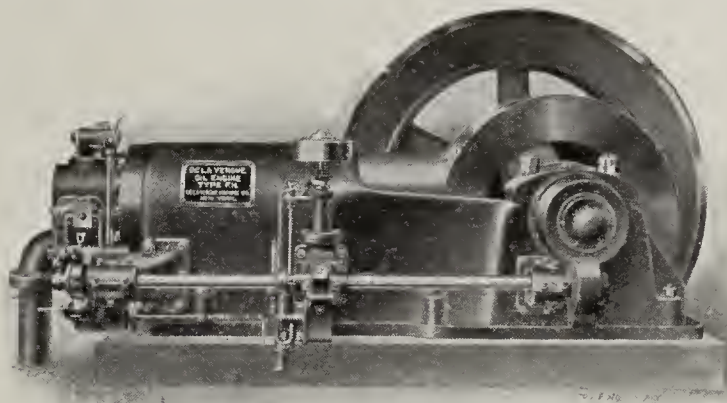
Fuel Consumption

The De La Vergne Machine Company offers this engine subject to a guarantee that its fuel consumption shall not exceed the following quantities of crude oil, distillate, or cheap fuel oil per BHP. per hour; the power to be measured on the engine shaft and the fuel to have a thermal value of not less than 18,000 B. T. U.

	Pounds
When running at full load.....	0.5
From $\frac{3}{4}$ to $\frac{1}{2}$ load.....	0.65
From $\frac{1}{2}$ to $\frac{1}{4}$ load.....	0.75

It is further guaranteed that, when operated at from three-quarters to full load, the fuel consumption of this engine per BHP per hour shall not exceed 0.65 pounds of any suitable residual tar, the same to have a thermal value of not less than 17,000 B. T. U., and to contain not over 2 per cent of water.

These guarantees are conservative, and lower consumptions are always obtained in practice. An oil



De La Vergne oil engine, type "FH."

consumption of less than 0.4 pounds per BHP. per hour has been more than once recorded. We have reports of a test made by Dr. Leonard Waldo, which showed a one-hour reading as low as 0.374 pounds of oil per BHP. per hour; and we have a report from the Snead & Co. Iron Works of Jersey City, who installed one of these engines to drive an electric generator about three years ago, which shows that during an intermittent run extending over several days, with a load factor of less than 50 per cent, they produced a total of 3,100 KWH. at their switchboard, with a total consumption of but 263 gallons of "Solar Fuel Oil." This is a most remarkable record, considering the low power factor under which the engine was operated.

An important feature of this engine lies in the fact that its efficiency does not fall off materially as the load is reduced, until the load falls below 30 per cent of its rating. The value of this feature to the average user need not be commented upon. A consideration of the Snead report, before mentioned, will give a clear idea of its importance.

Oils Available for Fuel

Of even greater importance to the public at large than the unusual thermal efficiency of this engine is the fact that it runs satisfactorily on the cheapest and heaviest grades of petroleum. The heavy oils native to California, Texas, Oklahoma and Mexico, which contain a large percentage of asphaltum, may be employed without the slightest difficulty. This is true also of many of the refuse tars produced as a by-product in the Arts. On several occasions oils and tars

have been tested experimentally which were too heavy to run from the can at ordinary temperatures. On warming them up, however, they became liquid enough to handle, and were found to be highly satisfactory from a fuel standpoint.

The type "FH" engine is the only engine on the market which will run satisfactorily on oils as heavy as 16 degrees Baume (.960 sp. gr.).

Fuel-Oil Tests

For the benefit of its prospective customers, the De La Vergne Machine Company will be glad to make tests of such oils as may be available in the customer's locality, by running them in a type "FH" engine. For such tests not less than a barrel of oil should be provided.

Rated Capacity

The type "FH" engine is manufactured in the following sizes:

Single Cylinder	Twin Cylinder	Four Cylinder
60 HP.	120 HP.	240 HP.
100 HP.	200 HP.	400 HP.
140 HP.	280 HP.	560 HP.

Advantages to Be Gained by the Use of This Engine

The advantages claimed for this engine are as follows:

1. **Low Fuel Expense**—Under the ordinary conditions generally existing, and the usual ruling prices of coal and fuel-oil, the fuel expense of this engine is the lowest on record, even taking into account steam turbines of large capacity. A gallon of fuel-oil weighs approximately $7\frac{1}{2}$ lbs. and a simple comparison of the money value represented by 0.5 lbs. of this fuel with that represented by the usual amount of coal required by the steam engine per BHP. hr. will leave no doubt in the mind of anyone as to the great economy of this apparatus.

2. **Simplicity**—The engine, compressed-air apparatus for starting, small water circulating system, an oil storage-tank constitute the entire plant. This may be contrasted with the high-class steam plant, with its boilers, pumps, heaters, economizers, and complicated condensing apparatus.

3. **No Stand-by Losses**—When the engine is shut down and the oil supply-valve closed, operating expenses cease until ready to start again. This is not the case with either the steam-engine or the gas-engine.

4. **Minimum Attendance Charge**—A licensed engineer is not required to operate this engine, and there is no need for firemen or other helpers. A small part of the time of one man constitutes the whole labor charge.

5. **No Shovelling of Coal or Removal of Ashes**—The fuel-oil is preferably handled by gravity, direct from the tank-car in which it is received, into an underground storage tank from which it is pumped by the engine itself. No refuse of any kind is produced in the operation of this engine.

6. **No Excessive Pressures**—High pressures mean frequent breakage and shut-down. This has been amply demonstrated by past experience. As a matter of fact, the average maintenance charge with this engine is less than with the steam engine.

NEW DETROIT OFFICE

The Link-Belt Company, Manufacturers of the Link-Belt Silent Chain Drive for the transmission of power, elevating and conveying machinery, locomotive cranes, power house conveyors for coal, ashes, etc., announce the opening of an office in Detroit, Michigan, Room 911, Dime Bank Building. Mr. L. W. Longan, formerly connected with Chicago and Indianapolis Works of the Link-Belt Company, has been placed in charge.

NEW CEMENT BRICK MACHINE

The Besser Manufacturing Company, 405 Fourteenth street, Alpena, Mich., who have recently placed a very successful brick machine on the market for making cement brick have the following to say concerning this machine which is illustrated in their advertisement in this issue of Cement & Engineering News on page 17: "The cement brick business hasn't prospered like the block business. That's because the cost of cement brick at the factory has been too high. The hand brick machines and some of the power brick machines have made a good product, but it couldn't compete with common clay brick.

The Besser Power Brick Machine has a capacity of from 50,000 to 60,000 brick per day. These brick are being made on this machine for from \$3.50 to \$4.50 per thousand. They compete in price and excel in quality the clay brick made by the old-fashioned, expensive kiln-burning methods.

This machine tamps the cement mixture into brick molds. The mixed material is elevated into a hopper, which feeds into sets of molds revolving on a cylinder. These molds pass under automatic power tampers which tamp the molds full. The surplus mixture is scraped off automatically, the face of the brick is troweled and two mechanical arms pick up the pallet-full and deposit it on the kiln car.

No human hand touches the material from the mixer to the curing rooms—the machinery does it all.

The result is a dense cement brick, hard as flint. It is stronger, more water-proof than a clay brick and can sell for the same, or a lower price.

We make a machine of smaller size with a capacity of 25,000 brick per day. Ask for our Power Brick Machine Catalog.

Herman Besser, president of the Besser Manufacturing Company states further regarding this brick machine: "I'm proud that I built a machine that will make good, honest, strong, waterproof cement brick that can meet clay brick prices right next to the clay brick yard.

"But I'm prouder of the fact that I have lighted on the only correct principle of molding concrete. That's a feature of this brick machine.

"The hopper feeds into the mold more concrete than is needed. Each brick is tamped by a separate, independent tamper. This tamper tamps the concrete until the mold—every corner of it—is full. Then the surplus is scraped off. You can't measure concrete into a mold and then apply pressure enough to make the concrete just fill the mold—mixed concrete can't be measured that accurately. You can't push it into the mold—one brick would be too large and the next one would be porous. You've got to feed more concrete than you need—let the variation of amounts be in the surplus, not in the product."

H. W. CALDWELL COMPANY'S NEW CATALOG

H. W. Caldwell & Son Company, Western avenue, 17th to 18th streets, Chicago, Ill., has issued Catalog No. 38, which is a very considerable effort in the printing line and is probably the best and most pretentious that this company has ever issued. The catalog covers in complete form the elevating, conveying and power transmission line of machinery manufactured by the Caldwell company. Full information on screw conveyors, gears, bearings, etc., is contained in the book and in its 800 pages are shown many illustrations and tables to make more clear the subjects discussed. Copies will be sent free to interested parties.

STEAM SHOVEL CHAIN

The Columbus Chain Company, Columbus, Ohio, and Lebanon, Pa., are now making what they call their "Hercules Solid Weld" steam shovel chain, guaranteeing every weld to be as strong as the solid bar.

They have spent a great many years of labor and investigation in getting a special iron suitable for steam shovel chain and in training a select number of skillful chainmakers to put it together so it will hold. They have now succeeded in doing this and claim for their "Hercules" solid weld chain that it will actually wear out before the links will separate.

Hercules chain is now used all over the world, having dug a large part of the Panama Canal, dredged the harbor of Havana and used on a large number of railroad systems of the United States and Canada. Where it has shown the best results is in stone quarries and rock work where the service required is of the very heaviest, and where the chain soon goes to pieces if it is not made right. Some of their "Hercules" solid weld chains are said to have been operated in rock work and run every day for a full year, continuous service, without developing a single broken link. "Hercules" solid weld chain is a little higher in price than other steam shovel chains, but the Columbus Chain Company have gone on the principle that an operator buys a steam shovel chain for the service he can get out of it, and that he is willing to pay a fair price for this service.

The Columbus Chain Company issue from time to time a circular telling about this special chain and giving testimonial letters from leading contractors, and cement, crushed stone, gravel, sand and lime manufacturers. They will be glad to send it to any one on request.

NEW LINK-BELT DATA BOOK ON SILENT CHAIN DRIVES

For the first time in history an engineering data book has been published by a manufacturing concern which will enable users of power to select the correct silent chain drives for their work and determine exact costs from list prices shown in the book.

Besides giving complete engineering information on silent chain driving in simple and compact form, Data Book No. 125 describes many uses of silent chain for the efficient transmission of power and gives specific reasons and illustrations showing application in a large variety of uses.

Link-Belt Silent Chain is a series of links connected by joints which consist of segmental case-hardened bushings and case-hardened steel pins. The chain is as flexible as a leather belt—as positive as a gear. Its rated efficiency is 98.2 per cent on actual test. It will transmit any amount of power quietly. Over 200,000 installations, we understand, were drawn upon for the information contained in this data book.

The book is the only work of its kind and consists of 112 pages, bound in flexible red cover. Copies can be obtained free of charge by addressing the manufacturers, Link-Belt Co., 39th street and Stewart avenue, Chicago.

KOPPEL CARS

An order for 500 brick dryer cars was recently secured by the Orenstein-Arthur Koppel Co., of Koppel, Pa., from the Bessemer Limestone Co., of Youngstown, Ohio. The Bessemer Limestone Co. were very much impressed with the construction of the Koppel equipment, and in specifying it hope to effect a considerable saving in time and labor.

Runs Even— No Edge Wear— No Spillage—

Goodrich LONGLIFE MAXECON CONVEYOR BELTS

reduce tonnage costs

Advise us regarding your installations. We make belts for every purpose.

Goodrich Products:

Conveyor Belts	Transmission Belts	Packing
Elevator Belts	Hose—All Kinds	Valves, etc.

The B. F. Goodrich Co.

Factories: Akron, Ohio
Branches in All Principal Cities



*There is nothing in Goodrich
Advertising that isn't in
Goodrich Goods*

*Makers of Goodrich Tires
and Everything that's
Best in Rubber*



STURTEVANT HAMMER-BAR PULVERIZER

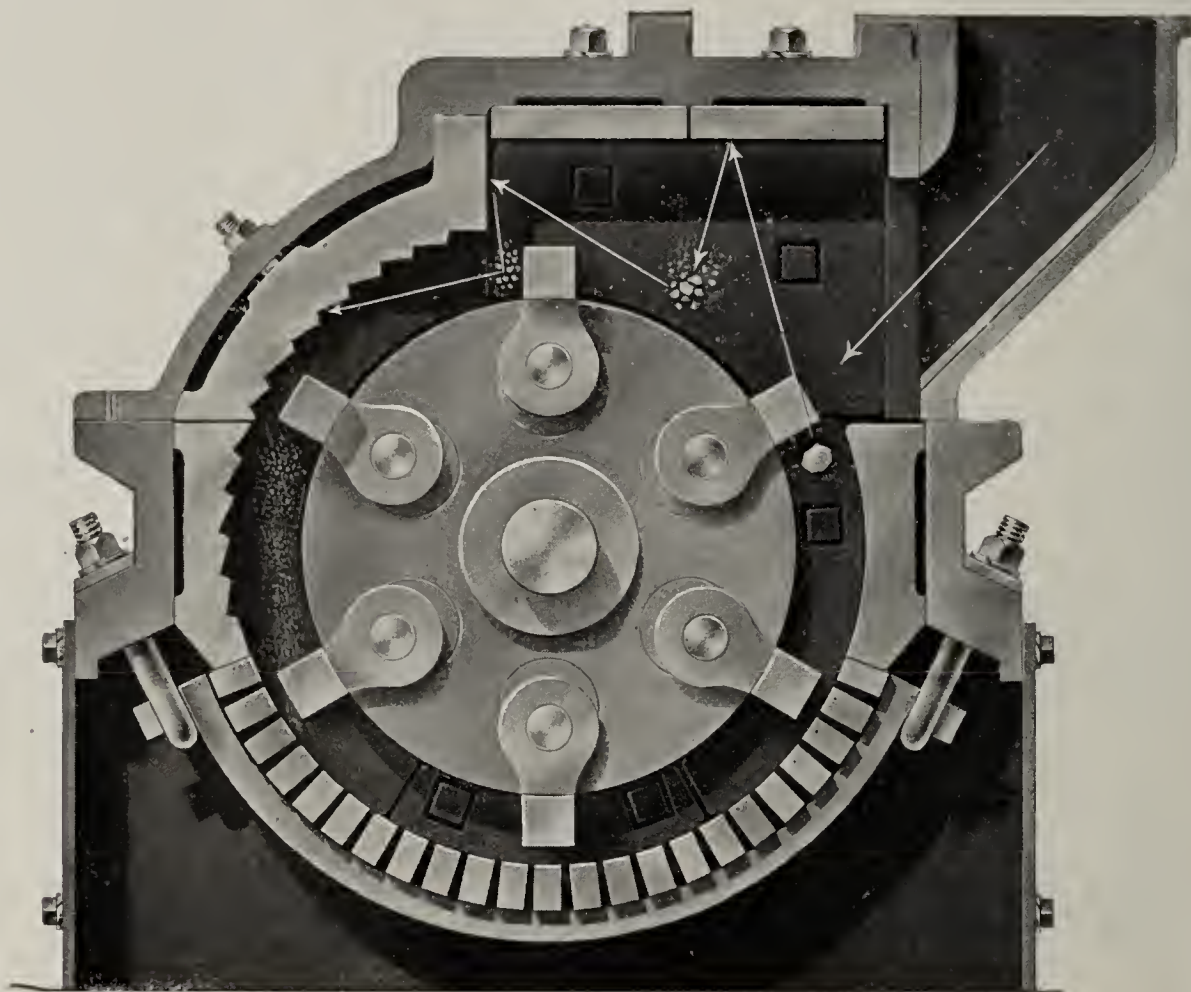
The Sturtevant Mill Company of Boston, Mass., have placed on the market a machine which is claimed to be an improvement on other impact pulverizers both mechanically and in principle of operation. They now have an unusually complete line of Crushing, Grinding and Screening Machinery, each suited to a special line of work, so their customers may select the best type for their purpose.

The Sturtevant Hammer-Bar Pulverizer crushes soft and moderately hard materials (up to and including all limestones in hardness). It represents the greatest efficiency in a Mill of this class.

steel, $1\frac{3}{4}$ " deep. The ground rock dashed through the openings of the grate is sufficiently pulverized, and is now violently ejected from the case. This relieves the hammers which otherwise would drag through material already sufficiently reduced. Thus there is no finished rock left to **repeat the circuit and waste power.**

It is clearly seen that, as soon as the hammers begin to rush upward again against the incoming rock, they resume their work of rock destruction.

This Mill is built extra heavy, and runs with practically no vibration, as it is perfectly balanced, and the hammer bars, held strongly out by centrifugal



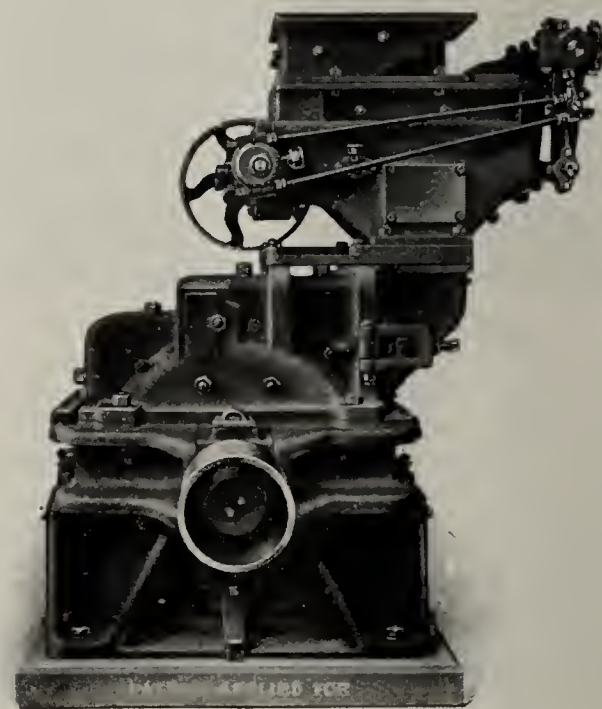
Description

The material fed may be as large as 4" to 5" in size, with soft rock, varying to $1\frac{1}{2}$ " to 3" for harder substances.

The rock is fed from an Automatic Feeder which drops it on the heavy hammer-bars of manganese steel which move **upward** to meet it at high velocity (just as the bat meets the flying base-ball). The impact is tremendous and the rock is smashed up against an armor breaking plate, from which it rebounds against another hammer bar **swung up** against it with the same smashing effect. Thus are dealt, against the rebounding rocks, a succession of terrific blows, and plate collisions (that recur 7,200 times a minute), resulting in an immense output of powdered stone, that cannot be duplicated in any other mechanisms.

Please note that the smashing action already described represents the **upward** stroke of a bar hammer against rock rushing to meet it. The result attained represents the highest possible efficiency. But when the hammer bars begin their **downward** path, efficiency is so diminished (the bat chasing the ball strikes a feeble blow) that another plan must be adopted--and the descending hammer bar is **now** brought close to a corrugated breaker plate where the greatly reduced broken stone is further pulverized between the high-speed hammer bar and the corrugated plate in close relation thereto. The hammers now pass close to the **bar grate**, made of the hardest

force, revolve with the sustained regularity of a heavy balance wheel. The bearings are of ample proportion, self-oiling, and dust proof. The hammer bars are of manganese steel, and the screens of the hardest and strongest material obtainable. "Open Door" construction affords immediate access to the interior of the case for inspection, and replacement of hammers, or grates, or screens.



WADE'S ACCESSIBLE SEWER SYSTEM

James J. Wade for years has been one of the most successful plumbers and done the plumbing and sewerage in many of the great skyscrapers and buildings of modern construction in Chicago. Years ago he did a large amount of repairing and refitting of houses where plumbing and sewerage were defective.

When called upon to repair defective or clogged up sewer pipe he always had trouble. It must be understood that the sewer pipe runs from the main sewer underneath the floor of the house cellar, and to find it and its lateral branches it became necessary to tear up the wood or concrete floor, which took a great deal of time and was very expensive. After the defective pipes were repaired and put in good order the floor of the cellar had to be relaid.

These troublesome conditions gave him the idea of devising accessible clean-out sanitary pipe fittings, with large manholes, connected with the main house drains and lateral branches. They are provided with extra heavy cast iron manhole clean-outs, extending from the sewer pipes in the ground to the level of concrete or wood floors of cellar. Each of these manholes has an extra heavy metal cover, fastened to the manhole, with electroplated lubricated steel bolts and gasket, easily removed any time by any unskilled person for the purpose of rodding, cleaning and flushing the main house drains or lateral branches without removing the floor of the cellar.

He secured patents covering the fittings and commenced manufacturing and installing what is now known far and wide throughout the country as the Wade Accessible Sewer System. Architects were quick to see its practicability, its great advantages and recommended and included it in their specifications.

Its recognition has been marked. J. J. Wade, the founder of the Wade Iron Sanitary Manufacturing Company, 18 E. Harrison Street, Chicago, said that it is the only accessible sewer system in existence in the world and that shipments are made from Maine to California and from Canada to Mexico. The Wade system complies with municipal ordinances governing house drainage work, corrects house drains, prevents disease and preserves life and health. The Wade Iron Sanitary Manufacturing Company has also recently placed on the market the Wade Accessible Flushing Clean-out Extra Heavy Cast Iron Gasoline and Oil Separating Catch Basins, provided with hinged clean-out door deep water seal trap combination and ventilating outlets and extra heavy cast iron grated floor drain basin, all of which are in diameter 18", depth 24", and are attached to the main house drain, and are installed in floors of garage buildings for the purpose of preventing gasoline, oils and similar oil substances from going out into the public sewers and house drains, thus protecting them against explosion, loss of life, property and health. This system is approved by the Health and Fire Prevention Bureaus of the city of Chicago.

USEFUL DERRICKS

The latest circulars of the Sasgen Derrick Co., 2053-57 North Racine avenue, Chicago, show their complete line of derricks for builders' purposes. Whether the building be large or small, the facility with which the Sasgen Derricks perform any of the necessary work will be a revelation to those who have managed to get along without one. The circulars indicate care and study which the manufacturers have given to the perfection of their numerous styles and will enable the contractor to select the equipment which he needs in his own business.

FLINT-RIM

Sprocket Wheels

For handling abrasive and gritty materials

The most durable and economical wheels on the market.



These wheels are made by a special process, perfected by us after many years of investigation and experience. They give a hard, smooth bearing service, free from sand. This surface extends to a depth of $\frac{1}{4}$ -inch to $\frac{1}{2}$ -inch and prolongs the life of the wheel far beyond that of ordinary cast iron. The life of the sprocket wheels made by the >FLINT-RIM< process is prolonged because it not only insures but *maintains* the correct diameter and pitch.

Write to us for records of service of >FLINT-RIM< wheels, and prices on our

MANGANESE STEEL CHAINS

The following Catalogs will be mailed upon request

No. 90 General Price list

No. 83 Elevators and Conveyors

No. 108 >FLINT-RIM< Wheel list

No. 79 Belt Conveyors

LINK-BELT COMPANY

PHILADELPHIA

CHICAGO

INDIANAOLIS

New York.....290 Broadway
Boston.....49 Federal St.
Pittsburgh.....1501-3 Park Building
St. Louis.....Central National Bank Building
Buffalo.....698 Ellicott Square
Birmingham.....General Machinery Co.

Seattle.....512½ First Avenue S.
Denver.....Lindrooth, Shubart & Co.
San Francisco.....Ely Machinery Co.
New Orleans.....Whitney Supply Co.
Los Angeles.....204 N. Los Angeles Street
Minneapolis.....Link-Belt Supply Co.

SHORT COURSE IN HIGHWAY ENGINEERING

The last legislature passed a law regarding Roads and Bridges which introduced new principles and methods concerning the construction and maintenance of roads and bridges; and the law also created the offices of County Superintendent of Highways and provides for the possible appointment of Township or District Superintendents of Highways. In view of the new principles of administration introduced by this law, and also in consideration of the entirely new duties devolving upon the County and Township Superintendents of Highways, and further on account of the recent radical changes in the methods and materials of hard road construction due to the increasing use of automobiles, the Civil Engineering Department of the University of Illinois will offer a course in highway engineering from January 19 to January 31, 1914.

There will be no charges of any kind by the University; and the course will be open to any one without examination or other condition. The work will be planned primarily to help the County Superintendent of Highways prepare himself for his new duties. The course will be open to any one who aspires to be appointed to the position of either County or Township Superintendent of Highways, and to any others interested in the maintenance or construction of roads. It is believed that the course will be valuable also to those who seek employment under the Illinois Highway Commission.

The details of the program are not yet fully completed; but will be announced later. A detailed program will be forwarded to any one requesting a copy.

The plan is to have two semi-technical lectures each forenoon and one such lecture each afternoon. These lectures are to be followed by discussions, laboratory exercises, or field demonstrations.

The lectures will cover the various phases of highway engineering; and will be given by members of the staff of the Civil Engineering Department of the University of Illinois and by Mr. A. N. Johnson, State Highway Engineer, and members of the staff of the Illinois Highway Commission. All are invited to participate in the discussions. The laboratory exercises are to show the methods of testing and using the materials employed in ordinary road construction, such as hydraulic cement, concrete, tar, asphalt, road oil, etc. It is expected to have several pieces of road machinery on exhibition with experts in charge to explain the manipulation and method of using each. Several manufacturers have already promised to exhibit machinery, and negotiations are in progress with others.

In the evenings there are to be semi-popular lectures which will be instructive to highway engineers and others interested in road improvement. Most, if not all, of these lectures will be accompanied by lantern views, and several of them will be illustrated by moving pictures.

NEW CONCRETE BRIDGE FOR CHATTANOOGA

The Market street bridge commission, in session last Monday afternoon, selected B. H. Davis, of New York, and Ellis Soper, of Chattanooga, as chief engineer and construction engineer, respectively, to design and build the bridge.

The selection, however, was made contingent on their designing a concrete bridge that will meet the approval of the federal government and not cost over \$500,000.

Failure to comply with the two conditions set forth will terminate the contract and the commission will be free to select engineers for a steel bridge.

For some time the bridge commission has favored a concrete bridge. With this end in view it has been in communication with government officials. It will be necessary to secure several concessions in order to

build a concrete bridge, these concessions relating to the length of the side spans.

The commission hopes to build a concrete bridge that will land on Water street, and to do this it will be necessary to have a low bridge with a lift span over the water channel. The span will be 275 feet long and will be of steel construction.

Engineer Davis, selected Monday afternoon, has had broad experience, being a specialist in concrete. He has designed some large bridges of the north and east. He will take up at once the designs with the war department officials.

CEMENT DRAIN TILE

Mr. A. D. Miller, proprietor, Goshen Concrete Tile Mfg. Co., Goshen, Ind., writes us as follows: "I note with interest what Wm. Passage of Bailey, Mich. says in the January issue of Cement & Engineering News regarding his failure with certain cement drain tile which he made on a 'Farmers' small hand-power tile machine and which he claims he laid in muck in the spring of 1910 and that, upon investigation in January, 1914, he declares he noticed the tile had decayed on the bottom—in other words the cement has disappeared. No wonder! I am not at all surprised! In the first place there was not enough cement. His mixture (5 to 1) was too lean. In the second place his machine was weak and useless. He should use a good, strong power machine, and in the third place his tile were not old enough when laid in the ground. Tile should all be manufactured with 3 parts sand and one part cement and cured in a dry kiln with a wet condensed steam or with a spraying system and should be kept inside 40 hours and also the tile should be made on a machine that will manufacture them very condense and the material should be wet and if these rules are followed he will have good, durable and guaranteed tile that will last in all kinds of soil to the end of time."

AN INTERESTING DUMP CAR

A shipment of a number of cars furnished the Lakeside Marblehead Railroad by the Orenstein-Arthur Koppel Company for use in ballasting, filling and construction work, was recently made. They are 12 yard hand dump cars.

The cars are all steel with wood floor planks inserted instead of being wooden cars tied together by a few iron bars and, therefore, repairs are reduced to minimum as the only parts which wear out are the floor planks and these can be replaced without disturbing the frame of the car.

The ends are steel plate reinforced by six heavy gussets which are riveted to the Long beams.

The doors are steel plate inside and outside with wood filler beams thus combining the elasticity of wood with the strength of steel.

The inside chains which usually are used on cars of this type to hold them in position have been omitted and an automatic locking device substituted; this consisting of a heavy cast steel hook at each blister. This hook engages downward-projecting links on the car. Both hooks on each side of the car are operated by levers placed on the end sill at diagonally opposite corners.

This construction makes it possible to unlock the car for dumping instantly and when the car is again brought to the upright position it locks automatically.

The underframe and end sills of the car have been made especially heavy and to conform with the Interstate Commerce Commission requirements, so that the cars can be shipped anywhere on their own wheels and axles in trains consisting of heavy standard gauge equipment without danger of being injured.

Lansing Broncho Batch Mixer

\$200 and
up.

Sizes 7 to 10
15 Cu. Ft. Capacity



No Other Mixer Combines ^{all} of These Features

Low charging for wheelbarrows or shovels. Measuring hoppers for those who want them. Side loaders for big jobs; high discharge for wheelbarrows or forms; simple, strong, powerful engine; non-slopping rings; quick mixing principles; ball and socket fifth wheel for short turn, and to avoid racking of frame on uneven ground; few wearing parts for economical up-keep; high wheels for hauling steel drum; machined bearings; steel channel frame; friction clutch for starting and stopping; quick mixing, cleaning and dumping principles. Most mixers have some, but the Broncho combines all of them—the most satisfactory machine made from every required standpoint.

We Also Manufacture

Continuous Mixers
Mortar Mixers
Hand and Power Mixers
Block & Brick Machines
Ornamental Moulds
Tools Barrows Carts
Scrapers Sand Screens
Mortar Hods
Mortar Trays, etc.

Send for Catalog

Better Than the Best

Only costs a fraction as much.

New 1914 Models

Here's the new 1914 Model Lansing Broncho—"The Daddy of All Mixers." A strong, powerful mixer that is better than the best and only costs a fraction as much. Not a cheaply made machine at a cheap price; but a high grade, first class mixer at popular price. A machine every contractor will be proud of. Strong where strength is needed. High wheels for easy moving; low intake for quick, easy loading, high discharge for wheelbarrows or forms. Easily cleaned; quickly and easily moved. Equipped with all of the latest and most modern devices, and built on the most modern and sensible lines, combining few wearing parts with great strength and speed.

1914 Models Are Marvels of Strength and Speed

They produce a quality of mix that every inspector accepts and pronounces *good*, doing it at most satisfactory rate of speed—600 batches and over per day, if required. Discharge operated instantly without the usual slopping. Mixer is reinforced, braced and strengthened at every possible wearing point. Machined track and bearings; channel iron frame (cross and corner braced), insuring the longest possible life and greatest wear. Designed to carry loads of from 1,000 to 5,000 pounds of concrete every batch, 10 hours a day, and 365 days in the year. Adopted by the largest and most exacting contractors in the country.

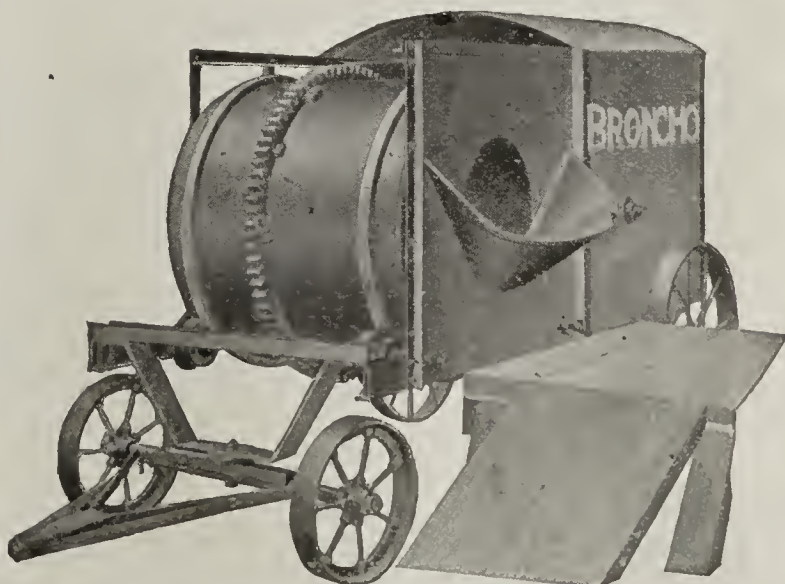
The Lansing BRONCHO is Truly the Biggest Value Ever Offered.

You don't buy mixers every season and you don't have to with the Broncho. Every dollar saved in equipment is so much more profit, and profits are what mixers are built for. Why invest in a cheaply built machine when you can get a well built, long wearing, well designed machine at the same price? Don't be content merely with a cheap mixer, but get a good mixer at a low cost. Do not invest a dollar in a concrete mixer until you have learned more about the Lansing Broncho. It is truly the biggest value ever offered in good machinery at low prices.

LANSING COMPANY
747 CEDAR ST. LANSING, MICH.

Branch Houses

New York Boston Philadelphia
Chicago Minneapolis
Kansas City San Francisco



CRUSHED STONE PLANT WILL DOUBLE OUTPUT

An output more than double that of last year is the plan of the Michigan Limestone & Chemical Co., Rogers City, Mich., for the coming season. Expressed in figures it means that where 1,100,000 tons of rock were shipped in 1913, this summer will see nearly 2,500,000 tons loaded into the great steamers and carried to the blast furnaces. The company plans on 176 working days this season, with two 10 hour shifts each day. Every 20 hours must therefore see about 14,400 tons of rock pass through the crushers and screens into the holds of the freighters. To accomplish this vast undertaking has engaged the attention of General Manager Carl D. Bradley and his superintendent J. L. Marsters and their assistants all winter. In the first place more capital was needed to make the necessary addition to the plant and this was voted by the stockholders in January. The details of financing the project have consumed the time since then to the present but now that that has been cared for, the entire attention of the executives is being devoted to the new construction work. The most important will be a new power unit developing 1,000 horse-power. This will more than double the present power plant. A 1,000 horse-power steam turbine driving a big generator will turn the steam into electricity, as the present plant does.

Another storage will be constructed on the south side of the dock and extending parallel to it. This will be used for the storage of the open-hearth or large rock. The present storage will be used for the medium stone, while the fines or rock under one inch will be used this year. In all, four sizes of stone are produced which requires a large storage capacity.

The loading facilities will be increased by the erection of two more loading bins, materially shortening the time in which a boat can be filled. Changes in the arrangement of the screens and washing devices will also be made to facilitate the quicker and more economical handling of the stone.

All these improvements must be made as rapidly as possible, as navigation will open about April 15, and the work must be well in hand by that time. The company has men at work now on the preliminaries, such as getting ready the foundations and laying out the site for the new construction, while the steel is being fabricated in Detroit by the Russell Wheel & Foundry Company.

SAND WASHER

Mr. E. G. Mason, Manager Iowa Sand and Gravel Company, Washington, Iowa, writes us that he wants to buy a second-hand Stocker sand and gravel washer.

MARQUETTE COMPANY BUILDS ROAD

The Marquette Cement Manufacturing Company's proposition to build at its own expense a modern concrete road up Shippingsport Hill was unanimously accepted by the Board of Supervisors of La Salle county, La Salle, Ill., last Saturday.

This company proposed to cut down the present steep grade of 12 per cent very materially, which will necessitate the moving of many thousands of yards of dirt. The full width of the road will be concreted from the Shippingsport bridge up the hill to a point opposite the Conway farm. Approximately one mile of concrete will be put in.

This work will be done free of all cost to the state, county or township, the Marquette company bearing the entire expense of grading, labor and all materials. The improvement will entail an expenditure by this company of upwards of \$14,000 to \$15,000. This pavement will connect with the concrete boulevard known as the La Salle-Oglesby Concrete Highway. It will be remembered that the Marquette Company bore a large portion of the expense when this road was concreted last summer.

The grade on the Shippingsport hill at the present time is very steep and the condition of the roadbed makes it almost impassable for vehicles. As this is a very heavily traveled road, this generous donation will be greatly appreciated by the community as a whole, and the Marquette Company is to be highly commended.

PORTLAND CEMENT PRODUCTION

The final figures for the Portland cement industry in 1913, as obtained by the United States Geological Survey on March 16, show a production of 92,097,131 barrels, shipments of 88,689,377 barrels and stocks on hand 11,220,328 barrels. It is somewhat interesting to compare these figures with the estimates made by the Geological Survey on January 15. These estimates were as follows: Production 92,406,000 barrels, shipments 88,853,000 barrels and stocks on hand 11,375,000 barrels, the percentage of error ranging from only .003 in production to about .01 in stocks on hand.

SARATOGA CRUSHED STONE

The Saratoga Crushed Rock Company, Saratoga, California, writes Cement and Engineering News that they use a Gates crusher and a Marion Steam Shovel, manufactured by the Marion Steam Shovel Company in their quarry. They are well pleased with their equipment. The capacity of their quarry is 500 yards per eight hours.

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PERFORMS ALL SLACK CABLE-WAY OPERATIONS
WITH EFFICIENCY AND ECONOMY

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Agents for Arizona, California and Nevada



The above cut shows our excavator at work in Iowa. The buyer is so pleased that he refers to it as the cheapest loading proposition he ever handled.

Among The Cement Mills

REGARDING THE OVERLOADED CEMENT SACK

The decrease in the use of paper sacks for the delivery of cement undoubtedly is due to overloading and overtaxing the strength of the present paper package, which will not stand either the rough handling in and out of the warehouse, nor the hard knocks, bumps and thumps received in transit and in switch yards. The major portion of this trouble might be overcome if the cement manufacturer could satisfactorily arrange to pack and ship cement in one-fifth barrel paper sacks of 76 pounds each, instead of 95 pounds.

It is difficult for any one cement manufacturer to take the initiative, because close competition compels extreme caution in changing established custom, though practically every manufacturer will agree that a single service container is the ideal method of delivery, if it can be used safely and economically. The fifth-barrel paper sack would solve the problem, because it is the extra 15 to 20 pounds that overtaxes any paper package, but the demand for such a package must come from the dealer and contractor.

The bag makers might create this demand, by convincing the cement-consuming trade of the advantages of the lighter weight package. This can possibly be done by personal interviews with contractors and dealers, who as a rule are quick to adopt any improved method in handling building material. To them it will mean quicker, easier and safer handling. It will relieve the cement manufacturer largely of a most annoying part of their business and they will doubtless be willing to adopt some such method, if the trade desires it. To the manufacturers of heavy paper bags, it should prove beneficial by the general increased demand for single service paper containers.

If this proposed change will benefit all concerned, would it not be well for the paper bag manufacturer to formulate plans as to the best method to educate the cement-consuming trade regarding the advantages that must accrue from this seemingly slight change in delivery? And, as the benefits, if any, must fall to all alike, is there any reason why the subject could not be taken up co-operatively by all interests?

NEWS ITEMS

The Iowa Portland Cement Co., Des Moines, Ia., will add to the equipment of its plant a 160 kw. motor-generator set, a 165 hp. induction motor, switchboard and accessories. The Ottawa Silica Co., Ottawa, Ill.,

will install for electric drive six motors ranging from 35 hp. to 100 hp., a small 50 kw. motor-generator set, switchboard, etc. The Riverside Portland Cement Co., Riverside, Cal., will operate for electric drive in its plant at Crestmore, Cal., nine motors ranging from 10 hp. to 200 hp., transformers, switches, etc. The California Portland Cement Co., Colton, Cal., will install for electric drive thirty-five motors ranging from 10 hp. to 50 hp., relay panels, switches, etc., and a 25 kw. motor-generator set. The American Cement Plaster Co., Fort Dodge, Ia., will install electric drive equipment comprising thirty-four motors ranging from 7½ hp. to 75 hp. switches and accessories. The General Electric Company secured the contract for installing all of the above mentioned electrical apparatus.

DEWEY PORTLAND CEMENT COMPANY

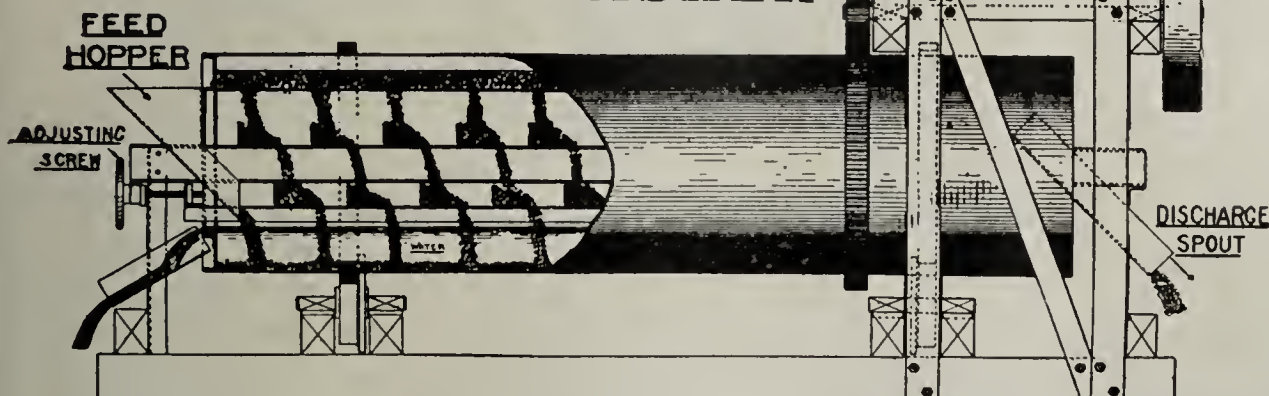
I note the news item in your March number wherein you state that the Dewey Portland Cement Company is installing electric drive in its mill at Dewey, Oklahoma, writes F. L. Williamson, vice-president and sales manager, Dewey Portland Cement Company, Scarrit Bldg., Kansas City, Mo. The article is true in part in that we have installed the equipment enumerated, but this is only a small amount of additional equipment that we put in when we built our coal grinding plant. Our plant has been electrically driven throughout ever since its construction. We have been using six gas engine driven electric generators directly connected, but with the installation of our coal grinding plant we added another unit, so that we now have in operation seven gas engine units. The motor generation mentioned is for the excitation of the generators and is a relay to the exciter units that we had installed.

Canada Cement Company

The exact output of the Canada Cement Company last year was given as 8,913,000 barrels. This is an increase of a little under 5 per cent. over the previous year and 100 per cent. over 1909. General Manager Frank P. Jones said that he did not fear competition from United States manufacturers. Thirty-five manufacturers across the line last year went into liquidation on account of selling the article too cheap, says the Toronto Canada Star.

The election of E. W. Cox in place of his father, the late Senator George A. Cox, was the only change in the board of directors.

DULL IMPROVED TUBULAR GRAVEL WASHER



The drawing above gives a general idea of the design of the Dull Improved Tubular Washer. The operative principle is that of tumbling the materials about in a bath of water as they progress through the length of the cylinder.

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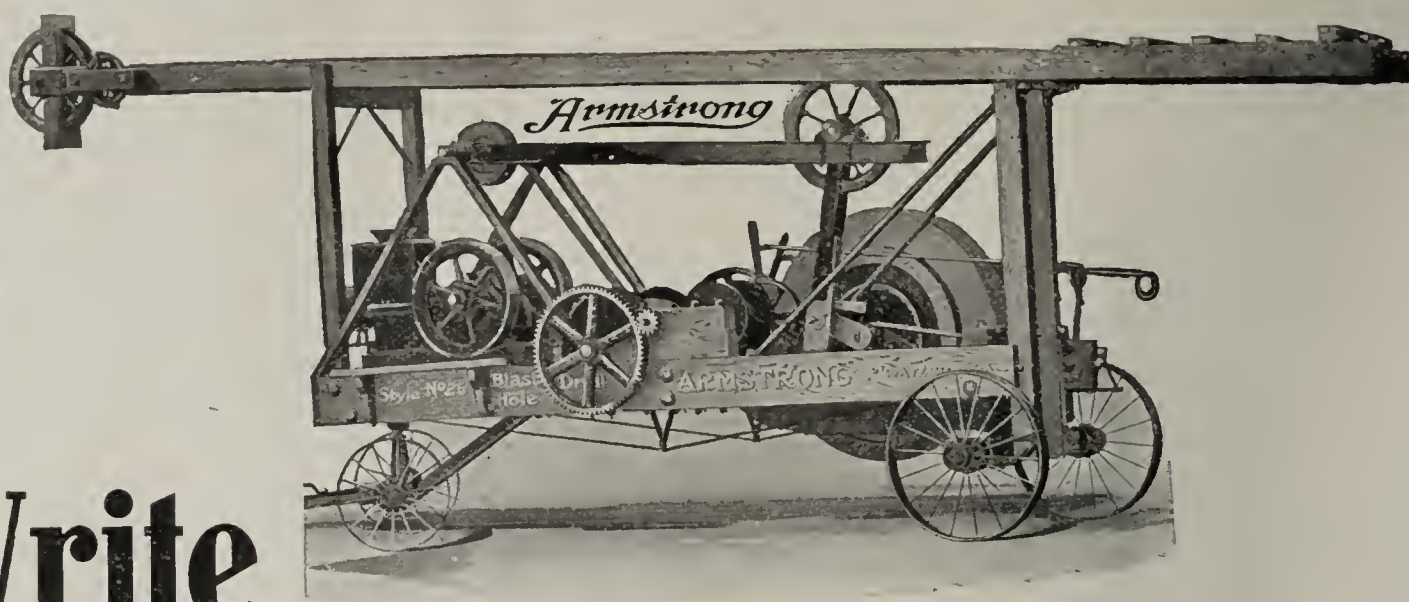
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The Armstrong Special Blast Hole Drill is *not* a well-drilling machine, but a specially built machine designed for the one job of drilling blast holes in rock, with a drilling motion and beam that more than doubles the footage drilled, cost considered.

At the same time this machine is working *faster* than any other, it is operating with less wear and tear on the equipment. It is easier to handle, gives longer service and *better* service every day it is in use.

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CONCRETE WORKING MACHINERY

A great deal of concrete and cement work can be done with no more tools than a hoe, a shovel and a trowel. The cost of doing work with these simple tools, however, is usually very high in comparison with that done by machinery especially adapted to the purpose. Mixing can be done by hand, but it takes many times longer to do as good work. It can be shoveled over and over and finally dumped into place, but the contractor wonders where all the money goes. There is also a lack of uniformity in the mix and a consequent variation in strength and quality. A mixer will pay for itself in a surprisingly short time in the extra amount of material it will turn out, in the better material which it will produce, and in the all-around satisfaction which the contractor feels at the end of a day.

A well-designed mixer is adapted not only to mixing concrete, but also for mixing mortar and plaster. It is surprising how many contractors still keep three or four men hand-mixing, and half-mixing, plaster, when by the exercise of a little common sense they would see the advantage of doing this work with a machine, saving the cost of labor and producing a much better material.

Plaster mixed by machine can be applied faster, and being perfectly homogeneous, can be applied in an even coat and with little liability of cracking, checking and showing other defects due to inferior mixing.

The Lansing Company, 747 Cedar street, Lansing, Mich., have just issued a very complete catalog showing a great variety of machinery for the contractor. It shows batch and continuous mixers operated both by hand and power, pumping outfits, contractors' hoists, carts, scrapers, tool carts, screens, wheelbarrows, collapsible bridge and culvert forms, drain tile molds and machines, concrete brick machines, block machines, silo and chimney forms, etc. The contractor, from this catalog, can bring his equipment and plant up to date or he can secure an entire new outfit at the most reasonable cost.

DOLCITO QUARRY COMPANY

We are advised by the Dolcito Quarry Company, 2118 First avenue, Birmingham, Alabama, who have a crushed stone plant at Dolcito, Alabama, that they use a No. 60 Marion steam shovel for digging and loading their material into 4-yd. dump cars. They

also use, exclusively, 60% "Red Cross Extra" dynamite, manufactured by Du Pont Powder Company, Wilmington, Delaware, for blasting. This powder gives entire satisfaction.

METHOD FOR CLEANING STONE WORK

A builder in Virginia had a contract involving the use of brick work with granite trimmings and he found it necessary to clean the stone work. He made the attempt with dilute acid, but it did not give satisfaction, although the stock brick around the trimmings cleaned up very nicely. The granite, however, still showed the streaks of dirt. He stated his case in a recent issue of The Painters' Magazine and the suggested remedy was as follows:

Builders' acid, which is equal parts of muriatic acid and water, will remove spots of mortar on brick or stone work, but is not the right material for cleaning stone that is begrimed from smoke and dirt. To accomplish this, apply to the surface, with a long-handled fiber brush, a strong solution of caustic soda or pearl ash. Let it remain on for about fifteen minutes, then wash several times with clear water, using a stiff brush or broom for the purpose. If this will not be effective enough, scrub the stone with a stiff fiber brush, using soft soap and concentrated lye and sand, allowing this to remain on the stone until nearly dry, then rinse with clear water, using a brush to remove the cleansing material. Protect your hands with rubber gloves.

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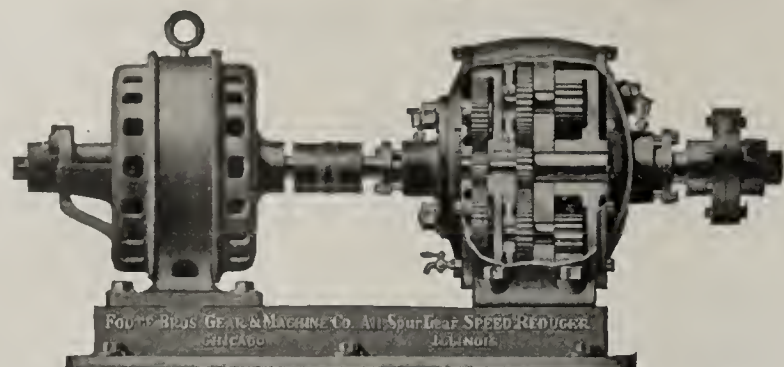
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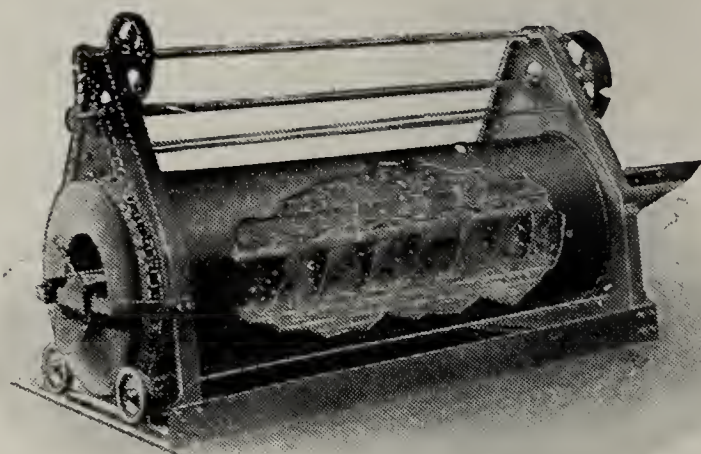
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There are only two machines that will dig material that is met with, and they are the steam shovel and the dipper dredge. By using the Bishop Patent Excavator, any derrick having a rectangular or a square boom can be converted into a steam shovel or a dipper dredge made out of a derrick boat.

This apparatus can dig anything a steam shovel will dig, and

its range is from the base of the derrick to the end of the boom and below the base of the derrick the length of the dipper arm.



WHY KEEP AN EXPENSIVE

steam shovel at work at the pit excavating sand and gravel when lower-cost equipment will do the same work? With your regular derrick you can dig material from the bank, you can excavate earth, you can handle loose materials on the construction job.

The Bishop Patent Derrick Excavator is an attachment that is readily adjusted on your derrick. It consists of a carriage traveling on the boom, a dipper and a dipper arm. A square or rectangular derrick boom, a double-drum engine and swinging gear are required. One man operates the equipment.

UNION IRON WORKS

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CEMENT & ENGINEERING NEWS

Vol. 26

June, 1914

No. 6



Pennsylvania Railroad Concrete Grain Elevators at Girard Point, Philadelphia, Pa. The illustration tells better than words the enormous capacity of this wonderful construction work. A. C. Shand, Chief Engineer for P. R. R.; James F. Cullen, Assistant Engineer; W. H. Cookman, Architect; James Stewart & Co., Chicago, Contractors for superstructure; Armstrong & Latta Co., Contractors for sub-structure.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

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Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, JUNE, 1914

ABERTHAW TESTS ON CONCRETE IN SEA WATER

A noteworthy publication has recently been issued by the Aberthaw Construction Co. of Boston, Mass., containing a description of the laudable efforts of a private company to determine the effect of the action of sea water and varying temperatures upon concrete piers of varying composition.

These experiments were made on test pieces of gigantic proportions, beams 16 feet in length, the manufacture of which is fully described in the pamphlet, and photographs of them are shown after different periods of immersion.

We regard these tests as the most remarkable that have been made in this country for a long time, and advise interested readers to send for the publication. In the following we briefly outline the method of manufacture and storing followed by the experimenters:

The first three specimens were made of one part cement, one of sand, and two of stone, and mixed dry, plastic and very wet respectively. The next three were made of approximately one part cement, two of sand, and four of stone, but so proportioned after mechanical analysis of materials that the excess of cement over voids of sand should be 10 per cent and the excess of mortar over voids of stone should be 10 per cent. These three were mixed dry, plastic and very wet, respectively. The next three were made of one part cement, three of sand, six of stone, and mixed dry, plastic and very wet, respectively.

Ten samples were made in pairs, one of each pair being mixed 1:1:2 and the other 1:3:6. All of these were mixed wet. Two were made from a Portland cement practically free from iron; two of a commercial Portland cement high in alumina; two of a commercial cement low in alumina; two of an iron ore cement practically free from alumina; two of slag cement.

The test specimens have been placed in sea water in such a way that the salt water rises nearly to the top of the specimen once in twelve hours, and that once in twelve hours the water drops. In cold weather the specimens are thus alternately frozen and thawed. Some of these specimens are mixed so lean in cement that they are necessarily somewhat porous, and it must be considered that any porous masonry subjected to this sort of treatment would show spalling. So far, after five years' immersion in sea water, one-third of the specimens are still intact. However, no final conclusions can as yet be based upon these tests. Only long years will show whether any of the specimens will prove permanent.

SAND-LIME BRICK FACTORIES

The new plant of the Winchester Brick Company located at Winchester, Mass., has begun operations and is turning out a fine grade of sand lime brick. The plant consists of three American Clay Machinery Company Wet Grinding Mills, two Sixteen Mold Rotary Presses and other equipment. The power used for operating the plant is electric power, the brick being hardened by steam from an independent steam boiler plant. The capacity of this plant will be 50,000 brick per day. The outlook is exceptionally bright for a very successful business.

The Yankton Brick & Tile Company of Yankton, S. D., are now erecting a sand lime brick factory for a capacity of 20,000 brick per day. The American Clay Machinery Company are engineering the plans for this factory, and the plant will be American Clay throughout.

The Boston Berkshire Composite Brick Company of Boston and Medfield, Mass., are now beginning work on the installation of their new factory, located at Medfield Junction, Mass. The American Clay Machinery Company have secured the order for the complete equipment, which will consist of four Rotary Presses. This plant will be operated under the silo process in conjunction with Wet Grinding Mills. The factory is being built for a capacity of 100,000 brick per day.

The Composite Brick Company, Jacksonville, Fla., are meeting with unusual success with their product, and although the clay brick manufacturers have been fighting the brick hard, the result of tests made on the Composite Brick Company's material has given them a firm footing in all building operations in Florida.

INCREASED USE OF CEMENT

Reports showing that the use of cement has more than doubled in the last half year were heard at the semi-annual meeting of the American Portland Cement Manufacturers' Association held in the Bellevue-Stratford at Philadelphia, last week. There have been 5,500,000 barrels used in the present year for concrete roads, as against 2,880,000 barrels in 1913. The concerns represented in the meeting have a combined capacity of 1,000,000 barrels annually. The annual meeting of the association will be held next fall.

METAL LATH

The Associated Metal Lath Manufacturers, 812 Wick Building, Youngstown, O., have published a bulletin, describing how an elevator enclosure made of metal lath and plaster stood up during a fire when the rest of the building, a brick structure built in 1858, was destroyed. The building was for many years occupied by the Roxbury Hose Guards.

Plant for the Manufacture of Sand Cement at the Lahontan Dam

By L. E. Sale, Lahontan, Nev.

The sand cement plant at the U. S. R. S. Lahontan Dam consists of one Allis-Chalmers 5x22 ft. tube mill, one 100-hp. Allis-Chalmers 2,200 volt, 575-r.p.m., 60-cycle, 3-phase motor; one 5-hp. motor, one silt bucket elevator, one cement bucket elevator, one Stephens-Adamson revolving screen, silt bin and cement bin, each with a capacity of 1,200 cu. ft.; two measuring hoppers, capacity 12 cu. ft. each; one screw conveyor, one 12-in. belt conveyor, Portland cement storage shed and laboratory.

A mixture of silt and sand is used in the construction of the tight portion of the main dam and bins for storing the material are located along the bank of the river. The sand cement plant is located at one end of this row of silt bins, which makes unnecessary an extra outlay to get the silt to the plant. An electric dragline scraper strips the silt from the gravel beds and piles it for loading by steam shovel into cars which haul it approximately $\frac{1}{4}$ -mile to the storage bins. The silt in its native state is very fine and dry and no grinding or artificial drying is necessary previous to mixing with the Portland cement, so an artificial dryer was not included in the equipment of the plant. The following is the detail cost of this plant:

Tube mill, including purchase price, freight and handling	\$ 2,505.49
Motor, including freight and handling.....	815.03
Elevators, screens, conveyors, including freight and handling	1,401.50
Materials for plant, lumber and concrete.....	1,167.19
Materials—	
For Portland cement shed.....	327.97
For building	58.32
For three-rail track.....	375.40
Miscellaneous	153.44
Supplies	637.65
Livestock or corral expense.....	140.00
Labor—	
Design and expert engineering	348.33
Foremen	48.00
Grading	122.60
Erecting building	1,666.88
Erecting cement shed	213.60
Installing plant	548.49
Laying track	299.77
Miscellaneous	388.26
Miscellaneous material, including freight and handling.	223.85
Engineering	157.25
Superintendence	113.85
Clerical	84.63
Camp maintenance	125.93
Overhead charges	353.77
Total	\$12,277.20

Method of Operation and Output

The Portland cement in original cars is switched in on a main line spur of the Southern Pacific R. R. and hauled to the plant by dinky locomotives on a three-rail track. At the plant the cement is loaded into the receiving bin by bucket elevators, or stored in the shed for future elevating. The silt is carried by bucket elevators to the screen where it passes through a No. 10 mesh wire cloth and thence into the receiving bin adjoining the cement receiving bin. Gravel and other residue is deposited in the gravel bins for the main dam by means of a chute. The extremely dry silt, which constitutes over 90 per cent of the pit run aggregate is then ready for mixing in equal portions with the Portland cement.

Underneath the receiving bins are measuring hoppers, the silt and cement being fed to them in the right proportions by reciprocating feeders. The mixed material is then carried by a screw conveyor

to the feed hoppers of the tube mill. Capacity of the latter being 56 cu. ft. From the feed hopper the sand cement passes through the tube mill, being ground until approximately 85 per cent passes through a 200-mesh sieve. The finished product is then carried by a 12-in. belt conveyor, driven by an independent 5-hp. motor to the storage bins at the mixing plant; the capacity of storage bin is 1,500 cu. ft.

A small laboratory is located in the same building as the tube mill, where hourly tests are made to insure a correct and uniform output.

Electric power for operating the plant is obtained from the hydro-electric plant installed by the reclamation Service on the Carson river at Lahontan. The power consumption amounts to approximately 5 kilowatt hours per barrel, with an average cost of $1\frac{1}{2}$ cts. per kilowatt hour.

Cost of Operation

Below is the total cost per barrel of sand cement for the month of August, 1913, and the total cost to date. The cost to date covers a period of one year with a total output of 20,155 bbls., and is higher than the August cost on account of designing and engineering charges and etc., prior to construction.

	U. C. per bbl. Aug., 1913.	Total U. C. per bbl. to date.
Cement and Silt:		
Portland cement at mill.....	\$1.192	\$1.192
Silt at mill	0.013	0.046
Sub. total	\$1.205	\$1.238
Handling Cement:		
Labor	\$0.004	\$0.004
Sub. total	\$0.004	\$0.004
Grinding Sand Cement:		
Labor	\$0.077	\$0.100
Supplies	0.007	0.020
Repairs	0.009	0.043
Power plant	0.087	0.086
Plant depreciation	0.200	0.200
Sub. total	\$0.380	\$0.449
Overhead Charges:		
Superintendence	\$0.044	\$0.066
Cement expert	0.000	0.008
Laboratory assistant	0.035	0.049
Sub. total	\$0.079	\$0.123
Totals	\$1.668	\$1.814

The average cost of Portland cement at mill is \$2.42 per barrel and the total cost to date, which is steadily being decreased, shows a net saving of \$0.606 per barrel. The approximate amount of cement to be used in the dam is 69,640 barrels, which means a saving in the cost of cement of approximately \$42,200, or a net saving of \$29,925 above the cost of the plant.

Character of Materials and Tests

The manufacture of sand cement being a comparatively new field, many questions will arise, prior to the installation of any plant, concerning the adaptability of the local material and the effect of local conditions on the finished product. The more important of these questions arising at the Lahontan plant were:

Could the sand-cement be treated the same in all ways as pure Portland cement?

Would any brand of Portland cement be suitable for grinding with local materials?

How would the sand-cement behave under cold weather conditions, and what effect would hot water have upon it if used?

Would the tests that are applicable to Portland cement insure the best quality of sand-cement?

What difficulties would be met in regulating the set?

Also, the ground water in the excavation where the concrete is placed contains alkalis known to have a disintegrating effect upon the concrete and it was desirable to know the probable extent of alkali action.

In order to arrive at some conclusion, experiments were made under the direction of Mr. W. J. Card at the Lahontan laboratory and, are being carried on at the present time.

It is shown by tests that concrete made of sand cement (50 per cent blend) with 20 per cent of sand replaced by silt resists alkali action effectually, while concrete made of pure Portland cement and straight sand is completely disintegrated in a period of from 6 to 18 months. From tests made in the laboratories of the Lahontan materials, the following conclusions were drawn:

That an amount of silt up to 25 per cent of the volume of sand used tends to increase the strength and imperviousness of the concrete; that it is unnecessary to wash the sand on this account; that cement replaced by silt, and the two only mechanically mixed, not ground together, decreases the strength of the concrete in direct proportion to the increase of silt; that grinding the blend too fine results in a flash set; that the ideal product consists of a mixture of 50 per cent silt and 50 per cent Portland cement being ground till an average of 82 per cent passes No. 200 sieve; that sand cement concrete requires more mixing and more water than pure Portland cement concrete; that sand cement concrete after being placed in forms, cracks and disintegrates unless watered constantly for a period of from one to three weeks, depending on weather; that hot water can not be used in mixing; that flour in the silt combines chemically with certain elements in the cement (probably the soluble silica with the free lime in the cement), thus giving increased strength; that an impervious concrete which will resist alkali action can be made without resort to "alkali proof" compounds, or water proofing materials such as soap, alum, etc.; that sand cement concrete is essentially a warm weather concrete; that the grinding of pure Portland cement with silt results in a material entirely different from Portland cement in so far as handling and making concrete is concerned.

The making of sand cement is a comparatively new field and as yet there are very few set rules by which its manufacture can be governed. There are many little things which cause a poor quality of the cement and, owing to their smallness, are the hardest to discover and rectify. The materials of one locality are like the materials of no other, and, while certain methods turn out an excellent grade of sand cement at Lahontan, these methods if used elsewhere, would likely result in absolute failure. When the exact requirement of each step in the process of manufacture is complied with, the resulting cement and concrete made of it is fully as strong as the pure Portland, and may be used for any purpose for which concrete of pure Portland can be used.

WHITE CEMENT

While Medusa Stainless White Portland Cement has been extensively used by the United States Government and also abroad, still it will be of interest to our readers to know that an order has just been received from the Isthmian Canal Commission, Washington, D. C., for 1,000 barrels of Medusa White Cement for delivery in March at Colon, Isthmus of Panama, for government work in the canal zone. This cement is made by the Sandusky Portland Cement Company, Sandusky, Ohio.

CRUSHED STONE BUSINESS

By L. H. Hawblitz

The rapid stride toward the development of the crushed stone business is due to two causes:

First, the demand on the part of the road and other officials, for material more properly crushed and screened, and

Second, the knowledge on the part of the stone operator that with better equipment and a more careful study of the details of producing a finished product, brings his reputation to a higher plane.



Dorr Steet, Toledo City Limits, Lucas County, Ohio, Three Years Old. Extremely Heavy City and Rural Traffic. Tar Macadam Construction. Photo Taken 1913.

There is no State in the Union that has larger and better deposits of limestone than has Ohio and for this reason we now have something like three hundred quarries in our State, producing annually nearly seven and one-half million tons of crushed stone; over one-half of which is used in road construction, the balance for railroad ballast, flux in furnaces and for reinforced concrete construction. This output is the result of an investment of approximately five and one quarter millions of dollars.



Western Reserve Turnpike, Wood County, Ohio. Built in 1842 and Resurfaced for the First Time in 1912. Water-Bound Macadam. Photo Taken 1913.

The process of quarrying limestone is somewhat different in various localities depending on the stratification of the deposit, but is usually carried on by the use of heavy blasting powder and dynamite placed into drilled holes and "set off" by means of an electric battery causing an explosion which fractures and breaks up the stratas to a size easily handled with steam shovels, then loaded into small cars that transport the broken stone and heavy boulders to the crusher. After passing through the crusher and reduced to a size ranging

from five inches down to dust, the product is elevated to the screen room where it is separated into sizes suitable for the various commercial needs.

The use of crushed limestone in the construction of our public highways is becoming more and more in demand. It has been demonstrated that limestone of the proper size, handled in the proper way, when placed upon our highways, gives results entirely satisfactory to the consumer and user and that in localities where we find traffic sufficiently heavy, that the asphalt, glutrin and tar products when used in connection with our stone gives results entirely satisfactory for the needs of the very heaviest kind of country road traffic. It is to be regretted on the part of the stone producer of Ohio that so many thousands of tons of his product have been thrown upon the public highway in a careless manner, trusting too much to Providence for results. The writer has the personal knowl-

failed on, as a type now obsolete and worthless. But, to the extreme gratification of the stone people of Ohio, we see each year changes made in specifications which, when followed out by honest contractors and inspectors, will give to the public "one hundred cents worth of road for every dollar expended," and will be entirely sufficient to take care of the traffic of the country highways within our State. It is also being proven that a well constructed macadam road of the various types, water-bound, glutrin treated, tar treated and asphalt treated, will take care of the traffic on at least 95 per cent of our roads at a first cost and maintenance far less than that of brick or concrete. This fact has long since been proven in eastern States and we are just now getting to that point in our own State. We find that with a better understanding between employer and employee, with higher wages paid, that we are able to bring about a more hearty co-operation in



Modern Stone Crusher Plant, Capacity 2,500 Tons Daily. France Stone Co., Toledo, Ohio.

edge that in one or two counties within this State the officials have been and are even now, dumping crushed stone along the middle of a public road, dragging it out to various thicknesses and then waiting for the rains to fall upon it and the traffic to roll over it in order that they may say, "We have constructed a water-bound macadam road which is well built and well rolled." This fact has opened the way for considerable criticism from those having some other type of road to sell the public and the guilty official who has failed to observe even the primary steps in successful road building, is apparently only too glad to take up the hue and cry of those advocating the more expensive types of roads, in order that he can cover up his own miserable mistakes and failures by condemning the road he

the organization of the various companies in the crushed stone business to the end that when a car load of crushed stone is shipped from any quarry in Ohio, that the material goes forward to its destination complying with the specifications for which it is intended and in this way we are emphasizing to the public our most sincere desire to co-operate with them in getting results and benefits, when our material is used, from the money expended by them.

KANSAS CITY CRUSHED STONE.

The John Prince Crusher Company, of Kansas City, inform us that they use a 45-ton Bucyrus steam shovel for digging and loading their crushed stone, and they also operate 4 Austin crushers, and this equipment is giving excellent satisfaction.

How Dynamite Can Be Used as an Aid in Road Construction

By S. R. Russell

Technical Division, E. I. Du Pont de Nemours Powder Company.

Most of the road work today consists either in reconstructing the old and established traveled highways or in building new roads through new country. The work in the first case may consist of any or all of the following tasks.

Elimination or reduction of heavy and objectionable grades.

Straightening curves.

Digging side ditches for proper drainage and for culverts.

Grading, resurfacing or macadamizing.

Elimination of mud holes.

Breaking boulders for stone crushers.

Straightening creek channels.

Planting shade trees along the roads, etc.

In the second case, besides the above, the right of way must be cleared of brush, trees, stumps and boulders.

To accomplish successfully and economically this class of work, dynamite is invaluable. Good roads cannot be built without breaking and rending rock, either to get it out of the way or to use it for filling up low places, or to prepare it for stone crushers. To do this, dynamite is absolutely necessary.

Dynamite can also be used to advantage for loosening up material, instead of plowing for removal by wheeled scraper or regrading with a King drag or road machine.

The road builder rarely has to make very deep rock or earth cuts. Consequently the problems met with in which explosives are used are comparatively simple.

It should be borne in mind, however, that a dynamite with a low freezing point should be used. It is particularly adapted for use in road building, as such work is usually carried on in outlying districts and the work is spread out over an extensive territory. Road building is often at its height during spring and fall, a time best adapted for road building.

For removing stumps and trees from the right of way several factors very materially influence the blasting of the stumps, notable of which are—

The character of the root, whether tap or fibrous.

The nature of the soil with regard to resistance it offers the explosive.

The state of preservation of the stump, whether sound or partially decayed.

Freshly cut or green stumps are much harder to blast than those from which the small fibrous roots and bark have decayed. Tap root stumps are easier to blast than fibrous rooted ones. The semi-tap rooted ones are slightly more difficult to blast than the tap rooted ones, but not so difficult as the fibrous rooted.

Successful and economical stump blasting depends on the proper location of the charge. For stumps of the tap root variety.

The usual method is to start a hole with a punch bar or dirt auger 1½ inches in diameter at a distance away from the center of the stump about equal to its diameter, inclined at an angle of about 45 degrees toward the center until the tap root is encountered. The earth tool should then be exchanged for a wood auger and the hole continued into the tap root. Care should be exercised not to bore entirely through this,

as in that case a good deal of the force of the dynamite when it explodes will be wasted in the soft ground beyond the tap root. The charge to be employed should vary from one to six cartridges of 40 per cent strength, the size of the charge varying in proportion to the size of the stump. The charge should be primed with blasting cap and fuse, and firmly packed, the tighter the better.

Having a blasting machine and electric blasting caps, the necessity of boring into the tap root can be avoided by placing the charge of dynamite firmly against the tap root.

Charges should be primed with No. 6 electric blasting cap and firmly tamped. It is necessary in blasting stumps to locate the center of the charge at a point beyond the center line of the stump. To accomplish this correctly, the hole should be of sufficient length so that the toe will be past the center line of the stump.

Stumps of a large diameter can be blasted out by the blasting cap and fuse method with a single charge by boring a hole past the center line and enlarging the end by firing therein one-quarter of a cartridge of dynamite primed with blasting cap and fuse. This small charge should be pressed down to the toe of the bore hole and should not be tamped.

Under no consideration should the hole be charged until it has had time to cool off. The best plan is to work on other stumps for several hours to give the chamber ample time to cool. After this the chamber is charged, primed, tamped and fired in the usual manner.

It is recommended, however, that large stumps be blasted electrically. This is done by boring or punching holes either partly through or under the principal spreading roots and one deep hole placed under the center of stump. All charges should be primed with No. 6 electric blasting caps, wires of which should be connected together in series to form a circuit. The first and last wires remaining should be attached to the two leading wires, which are connected to a blasting machine. Although large stumps can be successfully blasted by the ordinary blasting cap and fuse method, the electrical system is recommended, as there is an economy in dynamite and the results are more satisfactory.

The elimination or reduction of objectionable grades is of paramount importance in good road building. To do this requires cutting through rock, shale, gravel, clay, etc. For rock cuts, 40 per cent strength dynamite is the best explosive to use. For material other than rock, 20 per cent dynamite will be found to give the best satisfaction.

When making a cut through rock it is advisable to start the work at the lower end of the cut so that any water present will run away from the face. A row of holes should be drilled clear across the line of the road, spaced about 6 feet apart, and set back from the face about 6 or 7 feet. Holes should be driven 1 or 2 feet below the required grade in order to assure pulling the bottom. These holes should be loaded from one-half to two-thirds full of dynamite of 40 per cent strength. All cartridge shells, unless

there is much water present, should be slit longitudinally two or three times and packed down firmly with a wooden tamping stick. The last or next to the last cartridge should be primed with a No. 6 electric blasting cap. Damp clay or sand is filled in last on top of the last cartridge for several inches, and after that is pressed firmly down with the tamping stick until the hole is full. The next row of holes is drilled parallel to the face, and the same method of charging and firing is repeated until the entire cut is removed. If the cut is deeper than 16 feet, it is usually cheaper to remove the rock in benches of equal depth.

If the material to be excavated is shale, hardpan or cemented gravel, and the cut is not more than 6 to 8 feet deep, 20 per cent strength dynamite will be found best suited to the work. The holes can be spaced 6 feet apart, from 6 to 8 feet deep, and from 3 to 6 cartridges ($1\frac{1}{4} \times 8$ inches) of dynamite loaded in each hole. This charge will be sufficient to thoroughly loosen the material to permit of easy removal.

Much of the work of the road builder consists in grading the present highways, either to reduce grades or to prepare the road for a stone foundation. When the material is earth or clay, the ordinary method is to loosen it in successive layers by plowing. The plow loosens only about 8 inches of the material, which has to be removed from the roadway with a wheeled scraper, and then plowing and scraping continued until the desired grade is reached.

The cheapest, quickest and most economical way of doing this class of work is to shoot the material with 20 per cent dynamite. Holes are drilled to grade, spaced from 4 to 6 feet apart and loaded with from two to four cartridges of dynamite per hole, each hole being primed with a No. 6 electric blasting cap and fired with a blasting machine. By this method the material is all loosened up at one operation, necessitating no plowing, and is ready for the scraper.

Drainage of roadways is for two purposes: First, to remove water which reaches the surface of the road by precipitation and otherwise; and, second, to remove underground water which reaches the road from adjacent land or through the top surface. To accomplish the proper drainage of a roadway, it is absolutely necessary to have good ditches and to keep them clear. For digging ditches parallel to the roadway, and for culverts, 20 per cent to 40 per cent dynamite is recommended.

Blasting a ditch is a very simple operation. Holes are driven vertically with the punch bar to proper depth along the center line of the proposed ditch, spaced from 18 to 30 inches apart. The spacing of holes is governed by the nature of the soil. In moist, compact soil, the holes can be spaced farther apart than in dry, loose soil. Each hole is loaded with one or more cartridges of 20 to 40 per cent dynamite, one cartridge in each hole being primed with a No. 6 electric blasting cap.

In road work it is desirable that the side drainage ditches shall be shallow, consequently a good ditch can be obtained by loading $\frac{1}{2}$ cartridge of 40 per cent dynamite in each hole about 18 to 20 inches apart. Holes should be tamped full to the top with clay. If there is considerable water in the holes, tamping is unnecessary. The electric blasting cap wires should be connected in series and all fired with a blasting machine.

Where the ground is saturated or overflowing with water, ditches can be dug by spacing holes about 20 inches apart and loading each hole with one or

more cartridges of 50 to 60 per cent strength. The middle hole should be loaded with one or two more cartridges than the other holes, one cartridge being primed with a blasting cap and fuse. Only one detonator is required, as wet ground will carry the shock and detonate the other cartridge simultaneously.

The method to be employed in planting trees along the roadway is to punch a hole in the ground at the point selected for planting the tree, to a depth of 2 to 3 feet, according to the nature of the soil and location of hardpan, if any.

The usual charge is $\frac{1}{2}$ cartridges of 20 per cent strength dynamite per hole, primed with blasting cap and fuse. If soil is tight and hard, a whole cartridge may be necessary, and it would be better to use 40 per cent strength. Common practice is to plant the tree shortly after the holes are blasted. Some orchardists, however, believe that best results are obtained when holes for spring planting are blasted in the fall. This affords time for air, moisture, frost and sunlight to work on the subsoil and mellow it.

MEDUSA CONCRETE WATERPROOFING

The Medusa Concrete Waterproofing Co. writes us under date of May 9, 1914, as follows:

"The letter from the McCormick Waterproof Cement Co., published in your May issue, page 125, is certainly a very ingenious way of stating the case in regard to the decree of the United States District Court of Illinois, Feb. 13, 1914, in which the Medusa patent was fully sustained and the McCormick Waterproofing declared an infringement of that patent. This case has been appealed by the McCormick Co., and it is of course true that the decree of the District Court is suspended until the United States Circuit Court of Appeals shall give its verdict. Meanwhile the public should not be misled by clever evasions of the facts, or forget that a clear decision against the McCormick Company has already been rendered by the Court. Whether the Court of Appeals will reverse this decision remains to be seen."

HYDRATE LIME FOR WATERPROOFING CONCRETE WORK

The Holmes Lime Company, San Francisco, Calif., furnished 450 tons of their Vigorite brand hydrated lime to be used in conjunction with concrete on the basis of 10 per cent to the amount of Portland cement, for a large irrigation project constructed by the South San Joaquin and Oakdale irrigation districts. The use of this quantity of hydrated lime speaks volumes for its efficiency and economy in waterproofing concrete. The irrigation work mentioned includes a dam across the Stanislaus river at Knight's Ferry, and a concrete flume to carry the water thence to the districts around Oakdale, Cal. The dam is 78 feet high and 135 feet long, costing \$175,000, and holds in storage 100,000 acre-feet of water. The flume, which is being built by the Utah Construction Company, of San Francisco and Ogden, Utah, will distribute water to each 40-acre tract in the districts. Edwin Duryea, Jr., chief engineer of the irrigation districts, has supervision of all details of the work.

CEMENT MANUFACTURE IN JAPAN

Cement manufacture in Japan is about 43 years old. The first cement mill in that country was established in Tokio in 1871, and there the first rotary kiln was installed about ten years ago. The plant has been extended so that its annual output is now about 1,000,000 barrels.

Sand and Gravel Freight Rates

Lincoln Sand & Gravel Co.

v.

Chicago & Alton Railroad Co.

Complaint of discrimination in demurrage on cars, filed May 17, 1912.

Appearances—For the complainant, G. B. Gillespie, Attorney; for the defendant, W. L. Patton, Attorney. Case heard July 8, 1913.

Order of commission entered October 4, 1913, as follows:

The preliminary statement in the complaint in this case reads as follows:

"That we protest against the above named Chicago & Alton Railroad Company charging demurrage on cars furnished this company for shipping our materials, for the following reasons."

It will be noted that the complaint charges that the Chicago & Alton Railroad Company is unlawfully charging demurrage on cars furnished complainant for shipping its material, namely, sand and gravel, and for the following reasons:

"First—That empty cars placed for loading coal at mines or sidings or coke at coke ovens are under the demurrage rules exempt from demurrage charges. As we use the same class of cars, it is an unjust discrimination against us as shippers of sand and gravel and like commodities."

This paragraph charges unjust discrimination against complainant for the reason that empty cars are placed for loading coal, and that under the rules of the defendant company, such cars are exempt from demurrage charges, while cars placed at the sand pit of complainant, under the rules of the defendant company, are subject to demurrage charges. It is insisted that the character of the business is such, and the equipment used for the transportation of coal and sand is such, that the same rules should be applied to both. This contention must be considered from a practical viewpoint. The record shows, and we should take judicial notice of that fact, that sand is not a staple product like grain or coal, which products are sold upon the open market at all times and for which there is continuous demand. The sale of sand must, in the very nature of the business, be more of a specialty. It is an article mostly contracted for in advance of shipment for the reason, as the record shows, that it cannot be stored, but must be taken from the pit and put in the car; hence cars are rarely ordered except for immediate shipment. Coal mines, under a rule accepted by both the operators and the common carriers, have a rating which is a guide to the railroad company in furnishing cars; under this rule the shipper has no authority to order cars without limit, but is confined to his rating and the cars are set in upon that order. If his order is for ten cars and ten cars is the capacity of the mine, and ten cars are set in, but he loads only five cars, and orders ten cars for the next day, the railroad company is not required to furnish more than five cars, as the five cars left over the previous day are counted against him as cars furnished for the next day. No such regulation can be enforced against any shipper of sand, and there is no rule made fixing a limit for ordering cars for shipment of sand for the reason that there is no rating of sand pits, and the shipper of sand is therefore upon an equality with the shipper of live stock and commodities of that kind, and is expected to order cars when he needs them, and to load them

promptly and ship them out. Under the rules adopted and in force in this State, the railroad company cannot say to the sand shipper that his order exceeds the capacity of his sand pit, while the railroad company can say to the coal shipper that his order exceeds the rating of his mine. The record further shows that shipments of sand are only for parts of the year, while coal is shipped continuously. Without entering further into this controversy, it is sufficient to say that in the judgment of the commission, the difference in the character of the business is so well recognized, as to justify the rule for demurrage as applied by the common carriers, and that the application of such rule, as hereinabove stated, would not be discrimination against the complainant.

Hurd's R. S., 1911, Sec. 2, Chap. 114, P. 1835, provides unjust discrimination is committed when any railroad company "Shall make any unjust discrimination in the rates or charges of toll or compensation for the transportation of passengers of any description or for the use and transportation of any railroad car upon its road or upon any of the branches thereof, or upon any railroad connected therewith which it has a license or permission to operate, control or use within this State."

It will be noted that the above section applies to transportation, and it being agreed by counsel in this case that demurrage is not a part of transportation, and as the Act in relation to unjust discrimination in our statute applies wholly to transportation, for that reason, if for no other, the charge in the first paragraph of complaint must necessarily fail as to the matter of demurrage.

The second paragraph of said complaint is as follows:

"The cars furnished us by the Chicago & Alton Railroad Company are in such condition as to necessitate their being set in on the tracks in that section of our pit yard which is devoted to the cleaning and repairing of cars. Almost all cars received by us must be repaired before we can use them. This takes time and costs considerable money, and demurrage in part accrues on account of the condition of the cars given us."

It will be noted that this paragraph charges that the cars received by the complainant are in such condition when received that they must be repaired before complainant can use them, and that it costs considerable money and takes considerable time for complainant to make such repairs, and while making such repairs, the defendant company charges demurrage upon such cars, which charge of demurrage on account of such repairs, is unjust.

The law imposes the duty upon the defendant company of furnishing suitable equipment for the purpose for which such equipment is desired, and if it does not do so, the complainant may return such cars to the defendant company, or the complainant may repair such cars, in such a way as to enable him to use such cars for the transportation of product desired to transport, and for the time required by the complainant to repair such cars, the defendant company would not be authorized to charge demurrage and should not do so. Such time as is necessary for

the complainant to repair such equipment, if he sees fit to do so, cannot lawfully be counted as a part of the "free time" allowed the complainant for such equipment, and any charge of demurrage, made covering that period of time, would be unlawful. However, the receiver of such car or cars should, within the "free time" allowed, notify the common carrier of the condition of such car or cars.

The third paragraph of said complaint is as follows:

"We use coal at a season when they are not used in the shipping of coal and the railroads have a surplus of cars which would stand idle on their sidings if not used by us and similar shippers."

While it appears from the record that the state-

This paragraph is substantially a re-statement of the second paragraph, and we repeat that cars furnished by the defendant company in such a condition that the complainant does not desire to use them and does not use them, demurrage should not be charged against the complainant.

The fifth paragraph of said complaint is as follows:

"There is also a feature of our business which should be taken into consideration, namely: That the railroad company receives a larger sum in freights on material shipped by us than we receive for the material itself. We give you figures covering a period from March 27 to October 1, 1912, for consideration. We can furnish figures up to date if requested.



Country Home in Mesilla Valley, New Mexico.

ment in the third paragraph is in a large measure true, yet in our judgment, it constitutes no legal grounds for complaint against the defendant company.

The fourth paragraph of the complaint is as follows:

"Very often cars are set in on our siding in such a bad state of repair that we are obliged to return them to the railroad company. We sometimes are unable to switch these cars out so as to even return them to the company until demurrage has accrued. We receive all cars on our siding, and do all our own switching and delivering of cars to the railroad on its track."

"Invoice value of shipments made by us....\$17,688.21

"Freight paid to railroad based on rates to respective points to which shipments were made 24,495.30

"Excess of freight over invoice value of material 6,807.09

"Find attached list of 1,060 cars which we repaired at an average cost of \$1,076 during the period from March 27 to October 1, 1912. These cars were received from the Chicago & Alton Railroad Company, loaded with our material, and shipped to their different destinations."

The first part of said paragraph charges that the railroad company receives a larger sum in freights on material shipped by complainant than the com-

plainant receives for the material, and insists that this feature of the business should be taken into consideration in determining the merits of the case.

While it is true that it is an element that might be considered, it cannot have any legal bearing upon the question at issue in this case.

This same paragraph refers to list attached showing average cost of repairing 1,060 cars from March 27, 1912, to October 1, 1912, and charges that these cars were received from the Chicago & Alton Railroad Company, and loaded by the complainant and shipped over the defendant's road to their several destinations.

While the record shows that these repairs were made from time to time on these cars, and there is no contradiction of that fact, yet this commission has no power or authority to allow or reject such claims, and if the complainant has a cause of action against the defendant road, it is not before this commission but necessarily in the courts.

The case of Harrigan Brothers v. Wabash R. R. Co. is cited to sustain the views of complainant as to discrimination on account of the demurrage charge made against said cars delivered for sand and gravel transportation, while such charge is not made on cars for shipment of coal. The question presented in that case was, whether or not shippers must be served without discrimination, with switching facilities; the question of demurrage or general transportation was not involved. In that case the commission said:

"The question is clearly presented in the record whether or not a road may switch for some persons or shippers and refuse to switch for others; whether it may accommodate some patrons upon a convenient track and arbitrarily exclude others from the same privilege, making them go for their goods or material to another track less convenient.

"We believe that the position of the respondent that they have a right to receive from and deliver to some parties upon this "Y" and refuse the petitioners herein is wholly untenable. The principle of the law is fundamental that railroads being public carriers must treat all persons under similar circumstances alike. They must accommodate all who make application for the same kind of service in the same manner, extending favors to none and excluding none from equal participation in the use of their facilities. Railroads perform a public service and are called upon to exercise it impartially for every member of the public they are called upon to serve."

The above language can in no wise be applied as sustaining the views of the complainant as to discrimination regarding demurrage.

As to the question of extortion submitted, it is sufficient to say that all of the rates complained of are within the Illinois commissioners' maximum, and under the law as construed by our courts, cannot be considered extortionate.

By order of the commission, this 4th day of October, 1912, dated at Springfield, Ill.

(Signed)

O. F. Berry, Chairman.
B. A. Eckhart, Commissioner.
J. A. Willoughby, Commissioner.

GRAY AND DAVIS BUILDING

In the design of a new factory for Gray & Davis, manufacturers of electric starting and lighting devices for automobiles, the architects, Monks & Johnson, of Boston, were given the problem of producing as fine a structure for the purpose as could possibly be built.

Expense was not stinted to the detriment of any feature of advantage, either from the manufacturing standpoint or the aesthetic. The result has been a building of which the owners are so proud that it forms a prominent part of their regular advertising.

Located in Cambridge on the Charles River embankment, the building stretches its front of nearly 400 feet parallel with the river and at a distance of about



Interior View.

150 feet from the bank. The intervening space, partly a level lawn and partly boulevard, is reserved by the Metropolitan Park Commission as a permanent feature. The building is thus not only ideally situated as regards its immediate surroundings but it forms a very prominent feature of the landscape as viewed from the Boston side of the river.



Reinforced Concrete Columns with Mushroom Tops.

Five stories in height, with an usually large amount of window area, the treatment of the exterior has been such as to produce a most pleasing impression by the careful use of tapestry brick. The material of construction is reinforced concrete, a fact which is not disguised in the building itself, but the treatment of this concrete in conjunction with the brick has been done in a particularly happy manner. All of the pilas-

ters or wall columns are of concrete. The ornamental end bays of the building have been faced with brick, while the substructure is concrete. Those portions of the wall between pilasters which are not occupied with the steel sash windows are of concrete panelled with tapestry brick inserted in the concrete.

The main building measures 381 feet 6 inches in length, with a width of 81 feet in the first story and 61 feet in the other four. The total floor area is 134,258 square feet, or a trifle more than three acres. An ell in the rear center measures 36 by 62 feet. This runs through the full height of the building and contains elevator tower, stair tower, tool and store rooms, locker rooms, wash rooms and toilets. For the last three uses mezzanine floors are interposed above the first floor. This portion of the structure is framed in steel on account of the very low head room which would otherwise result.

The one story portion at the rear of the building and representing the difference between the 81 feet width of the first floor and the 61 feet width of upper floors, is used in the western end as a stock room for raw materials, as brought in from the railroad spur adjoining the rear of the building. The eastern end of this story is the garage and minor repair shop for cars belonging to the officials of the company. In the central portion, under the ell or rear tower, is the shipping room in direct connection with the railroad by means of the customary platforms. Skylights, over almost the entire area of the one-story portion, give ample light for all purposes.

The building has no basement. The main floor, of reinforced concrete, was laid directly upon the fill without the use of forms. It is thus practically a part of the solid earth. Piers were carried down to a solid footing at a depth of about 12 feet, where hard shale and gravel were encountered. These piers vary from 28 inches to 48 inches square, the footings being from 5 feet to 7 feet 3 inches square. In a few cases regular Gow footings were used, but expediency demanded in the case of most of the piers a construction which was more rapid with the facilities at hand. This first floor, as well as all the floors above, was figured for a load of 150 pounds per square foot.

All the columns in the building have mushroom tops. The columns are cylindrical, giving a particularly effective appearance, and of course the maximum of strength for a given weight of material. The columns are reinforced concrete, whereas the piers below them, being supported longitudinally by the hard fill and thus subject to compression only, are plain concrete without steel reinforcement. The columns in the wall are rectangular in section, each carrying under each floor a corbel for giving the floor slab that local support which it receives from the mushroom heads of the interior columns.

All floors above the first are of reinforced concrete, 8½ inches thick, these slabs measuring 20 feet square to centers of columns and being built without beams or girders of any kind. The top layer is about one inch of granolithic finish which was laid some time after the structure of the floor. In order to obtain a thoroughly good bond between the floor and the finish, the former was etched with hydro-chloric acid and then picked with a hammer to eliminate soft spots. In this way a splendid bond was obtained all over the entire surface. The large open space between supports, provided by the wide spacing of the columns, makes it possible to locate machinery almost without regard to interference from this source—a marked improvement over other types of structures.

The forms, except in the office portion, were made of corrugated steel, with the corrugations running

across the building. These corrugations, carrying the light direct from the windows, do not throw shadows or produce a mottled appearance in the ceiling. The head from floor to floor is 14 feet 3 inches; the net height 13 feet 6 inches.

Between the wall columns or pilasters a reinforced concrete beam, 36 by 8 inches, was cast in each bay. This is cast into slots left in the pilasters, thus making an expansion joint at each end of the beam. These beams form a portion of the outside wall of the building. As the lower edge of the beam is in the same plane as the ceiling, it will be noted that this beam extends well above the floor level and that the floor is dependent from it. By this means the windows are run clear up to the ceiling level and an absolute maximum of lighting is obtained. As a matter of fact, the window area is 64 per cent of the entire wall area of the building.

Steel sash is used throughout, in each case being so arranged that 33 per cent of the window area is adjustable for ventilation, etc. In the case of the office, which is on the second floor, the operating portion of the sash is double hung so that it may be handled as ordinary windows. In the manufacturing part of the building each ventilator sash is pivoted at the center.



Interior View, Gray & Davis Building.

The area available for ventilation thus figures out at 21 per cent of the entire wall area of the building. Natural ventilation alone is provided, no blower system being needed.

As would be expected in a building of these characteristics. Monks & Johnson have worked out details fully in keeping with the general scheme. To the observer, one of the most prominent of these details is the method in which tapestry brick has been used for the embellishment of the exterior. A splendid treatment was obtained with the use of 82,000 brick at a cost which amounted to about 1¼ per cent of the total cost of the structure.

Not only in the decorative sense has this thoughtfulness been shown, however. Many features of practical use have been worked out with the same care and attention to detail. A single instance is afforded by the way in which all pipe sleeves are arranged through the different floors. Instead of using a tin sleeve or one of galvanized iron, wrought iron pipe has been used in every case. These have been left three inches high above the floor as a precaution against the leakage of water into a lower floor at any time when water may lie upon any operating floor, either from the leakage of a sprinkler head, from water thrown on a fire, or from washing down the floor.

All conduits for the electric service, including both

lighting and power, are concealed in the concrete floors. This leaves no loose wires anywhere and conduces towards both appearance and freedom from trouble. Power outlets, with suitable plugs, are located in both ceiling and floors at convenient intervals, so that power will be available for any machine within an easy distance and with a minimum of trouble. A somewhat similar arrangement is the location of inserts in the concrete, four feet apart in both directions over the entire area of the ceilings in the manufacturing department. This makes it possible to attach shaft hangers or other pendant devices at any place where they may be needed.

The system of heating has been worked out very ingeniously, this being one of only three buildings in the United States in which the peculiar combination to be described has been installed. The unusual window area made it necessary to use a large amount of radiation surface for heating the building. To have provided this in the form of coils and radiators along the walls would have involved a great many large units, decidedly concentrated in the area occupied.

relatively cool and insulates the heads. At the same time it has been found in two other installations of this character that after a time a gas is formed under the sprinkler head which still further insulates it.

The stock and store rooms and tool rooms, located near the center of the east wall on each floor, are in the most convenient position possible for operation. They are in the same ell or annex in which are located the elevator and stairs, and hence are ready of access for the delivery of material.

In working out the locker rooms, it has already been mentioned that structural steel was used as a framework. In order that the columns might not interfere in any way with free use of the locker rooms it was arranged to use small columns, each made of two steel angles back to back, these being located in each case at the end of a row of lockers where they are completely out of the way and do not block the alley space. This provides a somewhat narrower column and beam spacing than might otherwise have been chosen, but worked in very well in connection with small I-beams as the basis for the floor structure.



Gray & Davis Reinforced Concrete Building, Recently Erected in Boston.

It was decided, therefore, to use the sprinkler piping in the ceiling as an auxiliary heating surface. This, of course, necessitated the use of hot water as a heating medium, with its ready control and adaptability to changing climatic conditions.

To guard the Grinnell sprinkler heads from the heat in the water and prevent the fusing of their solder links, with consequent leakage, the heads were placed on offsets about a foot long. The water in these offsets is, of course, not in circulation, whereas the system of piping is so arranged that continuous circulation is kept up from the riser on one side of the building to the return on the other in each of several sections. In this way the distribution of heat is kept uniform all over the building, while at the same time the pipes, being continually traversed by moving water, cannot become clogged in any place, as sometimes happens with pipes in which the water is stationary. The water in the offsets to the sprinklers is

The office end of the building is naturally the one in which the greatest attention has been paid to finish, although the outside of the structure gives no indication of this, aside from the entrance panel and the marquise. The office partitions are all of solid mahogany and glass, reaching a height of about 8 feet above the floor. The windows in this section have double hung sash in place of the pivoted sash in the manufacturing end. The radiators are of a very pleasing pattern, taking the place of the coils of piping in the factory.

In particular, Mr. Gray's office in the southeast corner of the building, and the director's room adjoining, have been worked out with an eye to the most elegant effects which could be produced. Both these offices have large fire places. The floors are laid in red tile and covered by heavy rugs. The windows are screened by silk velour curtains and all of the appointments are as fine as could be devised.

The whole office is located on the second floor at the east end of the building. The lobby on the first floor opens directly upon a broad staircase with easy flight, which lands near the center of the executive portion of the office, and permits ready access to all parts. Back of the private offices and separated from the main corridor by a wrought iron rail, the general office, occupied by clerks and stenographers, covers the whole width of the building. The broad corridor, running down the center from the head of the staircase to the door leading into the manufacturing department, and limited by the glass and mahogany partitions of the private offices, passes on through the general office without partitions on either side, the location of desks serving as a general outline to its course.

At the four corners of the main building wrought iron balconies have been added on the second floor as a touch of ornamentation, which is particularly pleasing. Painted a bronze green, they add a touch of color which blends well with the gray of the concrete and the mottled red and purple of the varicolored tapestry brick. The marquise has the same color scheme as the balconies and adds a further touch of ornateness to the east end of the structure.

In working out many of the details of construction, the architects, Monks & Johnson, were ably assisted by the contractors, The Aberthaw Construction Company, also of Boston; while the combined heating and sprinkler system was laid out and installed by the General Fire Extinguisher Co.

SPECIFICATIONS AND METHODS OF APPLYING STUCCO

First Coat

- 1 Bag of Hydrated Lime.
- 2 Bags of Cement. Mixed dry until the color of mass is uniform.

Second Coat

- 1 Bag Hydrated Lime, 40 lbs.
- 4 Bags Cement.

No Lime.

In Top Coat.

The best mortar is composed of three parts sand to one part of the cement and lime mixture. The proportions of one to three to be used in each coat, which of course, means the top will be a one to three Portland Cement Mortar. Use just enough water to enable it to work easily.

The first coat should be well scratched and second coat put on when the first coat is set enough to carry it.

The second coat should be scratched and the third coat applied before the coat below is thoroughly set.

Each coat should be wet before the next coat is applied to prevent the rubbing off.

Moisture Required for Setting

The best way to insure a good surface is to hang burlap or canvass a few inches away from the plaster and keep this cloth wet for a week.

Lath to Be Used

Metal lath alone should be used as it is free from temperature changes and the plaster is thoroughly reinforced, so the stucco becomes a reinforced concrete slab over the whole surface. Wooden lath should be green, or well soaked with water.

By using the above mixture, after securing practical plasterers to apply this stucco, there is no question why you should not get a first class job.

Lehigh Portland Cement Co.

RIB TRUS IN THEATRE BUILDING

In the new Jefferson Theater building, just being completed in Philadelphia, stringent building laws

presented a rather difficult problem to the construction of the Auditorium ceiling.

In that city it is required that the structural steel of such structures be protected with 3" of concrete.

This is usually accomplished by making the ceiling, which hangs below the structural steel work of



the roof, of a 3" concrete slab. This slab can be constructed in the usual manner with wood forms and the slab reinforced with rods or expanded metal, but the unusual height of the Auditorium made this type of construction both inconvenient and expensive.

However, after inspecting various types of self-centering materials, the bureau of building inspec-



tion finally approved 1", No. 26 gauge Rib-Truss plates, manufactured by the Berger Mfg. Co., Canton Ohio, for all spans not exceeding 3 ft.

The construction calls for plates resting on the flanges of angles or "T," which are bolted to the chord of trusses or other main bearings.

Over the Rib-Truss Plates is placed 3" of cinder concrete, and the bottom of the plates are plastered to form the finished ceiling.

It is interesting to note that Rib-Truss was given preference for this class of construction by the building department.

CONSTRUCTION OF CONCRETE PIPE LINES

By Arthur S. Bent

The story of the development of concrete pipe and the part it has played in the upbuilding of the Empire of the West, is of fascinating interest, and the enthusiasm of those who have had a share in its development may well be understood. So I hope to be pardoned for briefly reviewing this history.

The nations that have grown great and ruled the world, from the Bride of the Nile to wonderful Western America, have been those that lived in semi-arid lands and practiced irrigation. No older science is known to history. In our southwest may yet be seen the aqueducts of prehistoric races who flourished on lands watered from distant streams. And in this same region today we see irrigation in its highest phase of development, fairly advanced to the status of an exact science.

Climatic conditions in semi-arid lands are ideal for man's highest development and achievement and constantly spur him to his best efforts, and as the centers of population have grown in these regions, the vital problem has been to secure the full potentiality of the streams of water upon which life itself there depends.

Within a lifetime the semi-arid West was a desert. All of its marvelous possibilities lay dormant and largely unguessed. The climate was ideal, the land was fertile, and in the mountains lay a bountiful and unfailing supply of water. To bring these together was the problem. A medium must be found which would be inexpensive to construct, easy to maintain, certain in its operation and permanent in character. No demand of the human race was ever more splendidly met than when concrete pipe, the one perfect water conduit, stepped forth to fill this need.

And so concrete pipe has played a part of tremendous importance in the wonderful history of our semi-arid West and Southwest and is destined to be a most vital factor in its future development. In this domain of marvelous possibilities it is now and always will be, the connecting link between stored water and the land, and absolutely essential in this capacity because no other water conduit known can fill the mission so well. The uses and benefits of concrete in the world today are so manifold and vital that there is hardly a department of human activity which is not deeply a debtor to it, but in no other one, has it served so ideally and importantly as in this particular field. While the economical and satisfactory handling of water was but a short time ago an unsolved problem, today it is so perfectly solved by the modern concrete pipe irrigation system that we cannot conceive of any further development in this direction.

First of all, no other water conduit is so ideally adapted to its work. Indeed few uses of material for any purpose, are such that the use enhances the value and permanency of that material. But when we make a good concrete pipe and put it under ground and fill it with water, we have given it the very environment which will develop its greatest perfection and have subjected it to a service which of itself will indefinitely prolong its life and insure its permanency. Concrete pipe systems in southern California which have been in constant service for twenty-eight years, are today harder than granite, sound from end to end, and show the unworn marks of the core moulds with which the pipes were made. All other materials used for carrying water are at their best when first put in the ground

and must deteriorate, more or less rapidly, to the end.

So first and chiefly, the pre-eminence of concrete pipe as a water conduit is based upon its remarkable fitness for the service required, which is not even approached by any other material.

To this must be added its low cost which is again an unusual condition, for though the best is the cheapest in the end, it is seldom the least costly at the beginning. Concrete is nearly always cheaper to install than any other water pipe, not only because its manufacture is an inexpensive process, requiring but little plant, and easily obtained materials, but because it has to bear no transportation charges except for the cement. The pipe itself is very rarely shipped in the west. It is made on the ground wherever that ground may be, and in the rough inaccessible mountain regions, where water must chiefly be sought, it is usually the only type of construction that can be economically considered at all. In such locations we are able to manufacture the pipe in the bottoms of the great canyons, where both gravel and water are to be had, and hoist it by cableways to grade on the mountain sides, there rolling it along the trench to position.

This cheapness and availability of concrete pipe make it an important and indispensable factor in the development of new regions, where land values are at their low stage, and it is not too much to say that without it, certain sections, now highly prosperous, would have remained the homes of only the hardy pioneers.

But while concrete pipe, because of its availability, is the forerunner of land development in the west, it has not been left behind in the later rapid march to intensive cultivation, for it is today the indispensable adjunct of the orange and lemon groves of California, where values reach \$4,000 an acre. On such lands, where the conservation and economical handling of water is the very life of the industry, and where the citrus orchardist stops at no expense which will produce results, concrete pipe is the universal, almost the exclusive water conduit.

So it is strictly within the truth to say that the marvelous development of the irrigated West could not have taken place as it has, without that efficient handmaiden of agricultural prosperity, concrete pipe.

Irrigation was at first a crude affair. Within a generation, the orchards and fields of southern California, where irrigation has now reached the highest development in the world, were watered by simple earth ditches. The water was terribly wasted, its handling was costly, the canals were unsightly and troublesome. Farmers groaned under the burden, but that marvelous magician of the modern world, Portland Cement, was not yet an available commodity and its uses were unguessed.

It is about thirty years ago that the first crude attempts were made in southern California to manufacture and lay concrete pipe lines for irrigation. Portland cement at that time was not manufactured in the west and the imported cements cost about \$8.00 per barrel. Knowledge concerning the use of cement was meager and imperfect and still less was understood of the importance of the quality of sand and gravel and of the curing. Not long ago the writer ran across a man who had worked in one of these early pipe yards and from him learned that they mixed the pipe one to seven, punched it with laths into molds made out of stove pipe iron, propped it up with damp sand after being stripped, and finally lowered it tenderly into its grave with barley sacks, because it wouldn't bear handling. And yet remarkable to relate, some of the pipe so made, served the city of Los

Angeles for thirty-one years as a main sewer. Sewer pipe, mark you! Not water pipe. Sewage, which according to our clay friends, will dissolve, disintegrate, fletcherize and spit out, the very best concrete, in about two years' time!

Of course it was inevitable that the great demand for concrete pipe which rapidly developed, should result in much poor work, some of it ignorant, some of it dishonest. Scores of miles of lean pipe, dry mixed pipe, dry cured pipe, pipe made with dirty or badly graded materials, were rushed into the ground, being no less carelessly laid. Failures resulted by the wholesale. This gave the clay interests their day and for a few years considerable vitrified pipe was sold in some localities for irrigation use. But engineers and the public generally were learning to put their trust in properly made concrete and also learning how to make it properly, and for the last fifteen years no question has been raised as to the value and success of concrete water pipe. The fight against it now has centered on its use for sewers. But here also it is steadily and surely making its way, certain of ultimate success, and menaced only by the ignorant or careless methods of its friends. It is conservatively estimated that in Southern California alone there are in use 5,000 miles of concrete pipe.

Our own work has extended over the entire west and Mexico, including important lines in the most difficult parts of the Rocky Mountains of Colorado, at altitudes of 5,000 to 7,500 feet, and through burning deserts below sea level. In the mountains of Mexico with Mexican labor, and on the western Mexican plains, with Indian labor. In zero weather in Oregon and a temperature of 120 degrees to 130 degrees in Arizona. It has been hauled with ox-carts and motor trucks; on mule back and by cableways; on skidways and sleds. It is laid through tunnels, under railway systems, along rock cliffs, in ocean sands, across trestles, under water and through alkaline swamps. The mere mention of these conditions suggests the marvelous adaptability of concrete pipe and opens up a vision of tremendous and ever-increasing field of usefulness before it. A field absolutely unlimited if we in whose hands it lies, only are wise enough to intelligently and conscientiously develop the industry.

There need be no failures under any conditions. The recipe for success is simple. Use tested cement. Use sand and aggregates that have been passed upon by some competent engineer and proportion them according to his instructions for securing the greatest possible density. Mix your concrete one part cement to three parts combined sand and aggregate. Use only a power batch mixer and be sure the batch is of a perfectly uniform color before water is added. Use approximately one-half as much water to a batch as you do of cement. Feed the concrete into the molds as uniformly as possible in layers that will not be over two inches thick when tamped hard with a heavy iron tamp having a thickness three-fourths the thickness of the pipe shell and a face length of 4 to 6 inches. Don't patch up any cracks—take such pipe down at once and remold. Keep the pipe constantly wet for seven days—never allowing it to turn gray. Then coat it on the inside with a neat cement paste so thick that it will scarcely drip off the brush. Don't let any pipe go below 45 degrees above zero during the first three days. This roughly described method will give you a pipe that you can safely guarantee for low water heads, say from 10 feet to 20 feet, according to the size, and can guarantee against the action of alkalis or sewage, or any other unfavorable condition.

The chief points wherein the above specifications differ from ordinary practice are the slow feeding and

the wetness of the mix, and on this last too much emphasis cannot be placed. Most failures are due to dry mixed pipe. The manufacturer who for the first time attempts to use the quantity of water here mentioned will be discouraged by the inability of his men to get the molds off without cracking or destroying the pipe. He will probably feel that it can't be done. For his encouragement it should be said that we have trained our men in this direction until they can turn out as many feet of this very wet and sticky pipe as they once could of the dry pipe, and we make it wet to the point of distortion. We go even beyond this, using a band around the top of the pipe immediately when the jacket or case is stripped, to take care of the distortion which we otherwise could not prevent. Making such wet pipe will increase your difficulties, increase the weight of your pipe, reduce the number of feet you will get from a barrel of cement, worry your men and reduce your profits until your vastly improved quality begins to be recognized and demanded. After that you will say it is the best move you ever made. You will be able to demonstrate, as we have done, that the very best concrete made is that which is just as wet as can be compacted by a blow. Wetter than that is not so good (though it must be so used when reinforced), and dryer than that is still poorer. By such methods we are able to produce 8 inches with a 1 $\frac{1}{8}$ -inch shell that will stand 125 to 150 pounds water pressure, and this without any reinforcement or waterproofing whatever, and 30 inches with a 2 $\frac{1}{4}$ -inch shell, standing 25 to 60 pounds.

Concrete pipe is the very warp of the fabric of arid land development and its use has extended to every civilized region where water is conveyed to soil. So ideally does it perform this service that we may claim it will ultimately carry all the irrigation water of the world, and that where concrete pipe is most used will be found the most competent civilization and the arena for the highest achievements of the human race.

SILAGE FOR FATTENING STOCK

Henry Park, of Sycamore, Ill., fattens steers for the market. Three years ago he put up a monolithic concrete silo and had such good results with the silage that he put up a second concrete silo last year. The capacity of his plant is 170 head of cattle. He feeds silage, corn and cotton seed meal. A telfer system from each of the silos carries silage directly to the mangers within the barn and to feed troughs outside. The silos are 16x40 feet and cost him \$450.00 each. Besides this cash payment he hauled the gravel and cement needed for each and boarded the men during construction. This is a cost of \$2.50 per ton of silage.

Mr. Park is more than satisfied with his concrete silos. He has told the contractor who built them that as fast as he increases his plant he is going to build more concrete silos identical with the first two.

The work was done by Tibbits, Incorporated, of Sycamore, Ill., who used Polk-Genung-Polk Co.'s forms. They are doing considerable silo building in the vicinity of Sycamore.

TRADE NOTES

The Tishomingo Concrete Tie Co., Tishomingo, Mis., has been incorporated with a capital stock of \$200,000, by A. E. Robinson, J. T. Whitener and M. W. Cozart, and will manufacture concrete ties, etc.

The Standard Concrete Machine Co., Indianapolis, Ind., has been incorporated with a capital stock of \$25,000, to manufacture concrete machinery. The directors are H. F. Schoen, C. B. Henkle and C. H. Halt.

A Large Rock Crushing Plant

Recently Completed in Canada

On March 9, 1914, we received the following letter from Mr. S. B. Martin, President and General Manager of the Martin International Trap Rock Co., Ltd., Bruce Mines, Ont., who have just completed one of the largest crushing plants in Canada. They own seven hundred acres of the very best of trap rock.

"I am sending you a photo of our plant, which is 520 feet long, not including the power house, just the crushing plant. The top of the building at the top of the second pan conveyor is 118 feet high. When this picture was taken we only had a small amount of stone on one stock pile; we are now prepared to pile the stone in six different piles, each pile a separate size. This storage capacity will hold 75,000 tons. We are able to load into boats from these piles at the rate

In our quarry we use Clipper drilling machines, drilling 6 inch holes, 60 feet deep, and we are thoroughly pleased with these machines, as they drill the holes very economically and give perfect satisfaction. The Clipper blast hole drills are made in Tiffin, Ohio, by the Loomis Machine Co. We use dynamite manufactured especially in 4x8 inch sticks of 5 lbs. each, 60% low freezing, and we are using the largest steam shovels the Bucyrus people make with five yard dip-pers.

We use twenty Kilbourne & Jacobs 8-yard quarry cars, which I think are the most economical and best built quarry cars manufactured, and we employ two Vulcan 15x24 standard gauge locomotives, manufac-



The New Crushing Plant of the Martin International Trap Rock Co., One of the Largest in Canada. Seven-Belt Conveyors, Made by the Revere Rubber Co., Chelsea, Mass., Were Installed in this Plant. All the Crushing Machinery Was Purchased of the Power & Mining Machinery Co., Cudahy, Wis.

of 1,000 tons per hour. The stone is automatically weighed as it passes over a weightometer, manufactured by the Merrick Scale Mfg. Co., of Passaic, N. J. We have two of these equipments for loading and weighing and are able to run them both at one time, each one handling a separate size of stone.

We have just completed our plant within the last ten days (March 1, 1914) but operated it some last Fall, being able to test capacity of it, which we found

tured by Vulcan Iron Works, Wilkesbarre, Pa., in our quarry and we are well pleased with them. They give entire satisfaction.

Our power house equipment is of the best that is manufactured, consisting of two Erie City water tube boilers each of a rated capacity of 500 h. p. Each boiler is equipped with two automatic Jones underfeed stokers, together with Foster superheaters. With one of these boilers we are able to get enough h. p. to



View of the Quarry of the Martin International Trap Rock Co. in Canada. "Clipper" Blast Hole Drills Are Shown; Also "Bucyrus" Steam Shovels and "Vulcan" Dinkey Locomotives.

to vary from the rate of 450 tons to 640 tons per hour, owing to the stone. We are able to take stone from our quarry and deliver it into our crushers as large as 5 feet x 7 feet and whatever lengths the stone may be. The largest piece we have had so far was 4x6x10, containing 240 cubic feet, or nearly 22 tons, and in less than five minutes this stone had passed through the entire plant that we had complete at that time up to the second screen and had dropped on the stock pile.

operate our entire plant. Our engine room consists of one Cross Compound Erie City Lentz patent engine with a 13 inch x 22 feet crank shaft with two rope groove fly wheels, one carrying twelve 2 inch ropes to run the main line shaft in the plant, the other one carrying six 2-inch ropes that run direct to our large Superior Jaw crusher. We also have one 365 h. p. Lentz patent four valve engine to drive our generators to generate electricity for our loading motors as well as stacking conveyors, together with lights and motor

to run machine shop. We use practically all rope transmission in our entire plant consisting of 1 inch, 1¼ inch and 2 inch, totaling sixty-two ropes in all. With our power house equipment we are able to start our crushers, conveyors, and screens when under load which is a great advantage to any crushing plant.

I think we have the most up-to-date crushing plant in North America. Our buildings being all concrete and steel and machinery the very best we could buy. The crushing machinery was purchased of the Power & Mining Machinery Co., Cudahy, Wis., and consists of five crushers; one 5'x7' jaw crusher, two No. 9 McCully gyratory crushers and two sets of 24x48" Superior rolls, and necessary screens and conveyors to screen the stone in six different sizes. We have seven belt conveyors and we use rubber belting for conveying and transmission purposes. These belt conveyors and also the rubber belting was manufactured by the Revere Rubber Company, Chelsea, Mass., and we are well pleased with same."

NEW METHOD OF REMOVING OVERBURDEN

In many quarrying operations in this country one of the greatest difficulties experienced is in the removal of the overburden. The merchantable stone may be overlain with many feet of earth and wild rock. To strip this means a great deal of effort and large expense. Many deposits of very valuable stone, for which there is a ready market, have had to be abandoned because of the amount of top soil. In a few cases the stone has been gotten out by tunnelling but this process is not always possible because the top may not be sound enough to serve as a roof. An account is given in a foreign technical journal of a method of removing overburden practiced in a German quarry that may offer suggestions of value for some operations in this country.

In the tuffstone quarry at Kretz, in the Nette Valley, worked by the firm of D. Zervas, Jr., of Cologne, the solid stone is covered to a depth of between 75 and 80 feet by volcanic ash and other waste material. The removal of this pulverulent and naturally closely packed deposit in the ordinary manner, in slopes or steps, is costly and extremely difficult—especially as for about two-thirds of the mass there are compact beds, which might easily be a source of danger by slipping in constructing a slope. The operating company has now successfully tried a new method, whereby the overburden can quickly be removed in large masses and also put to useful purposes.

The accompanying plan, which is reproduced from the official organ of the quarry workers, published at Charlottenburg, will give a pretty clear idea of the method that is followed. Galleries are driven to a distance of about 60 feet perpendicular to the quarry face at the base of the overburden. These galleries are placed about 25 feet apart, and at a distance of 15 feet from the front they are connected by a cross gallery running parallel to the quarry face. In one instance a second cross gallery was driven behind the first. The intervening spaces are then pierced by a series of horizontal bore-holes to a depth of 10 to 12 feet, and these are charged with blasting powder in watertight cartridges. Vertical bore-holes about 4 inches in diameter are next driven from the surface to a depth of about 50 feet and at a distance of 25 feet from one another and a little greater distance from the quarry face.

The shots in the galleries are first fired, batches of about six being exploded simultaneously by means of a battery. Then the vertical bore-holes are charged and exploded in sets of 3 at a time. In the first ex-

periment, with only a single cross gallery, about 1,300 pounds of blasting powder loosened more than 4,200 cubic yards of overburden, which was partly thrown down to the bottom of the quarry. In the second case, with two cross galleries, half a ton of blasting powder brought down about 7,000 cubic yards of rubbish. The material which was not thus removed was then swept to the quarry bottom by a water flush. This was accomplished by means of a 175-horsepower hydraulic plant, which pumps ground water from the quarry into a system of pipes, arranged along the margin of the mass of overburden which is intended to be washed down. A number of outlets in these pipes enables the water jet to be directed upon any desired portion of the overburden. The overburden thus removed, whether by blasting or by water jet, is swept into the lower part of the quarry and serves to fill up and make good the worked ground. Formerly this overburden was removed by water jet alone, but the above described method of blasting has resulted in performing the operation in a third of the time.

Hydraulic stripping has been used with good effect in many quarry centers in this country. It is the method that is generally employed at Bedford, and it is suitable wherever, as in the Indiana limestone district, there is an overburden of loose soil. It would scarcely be attempted where the top was very heavy, where it consisted of shale or hardpan, or where it was mixed with ledges of wild rock. But in combination with the blasting chambers, it should prove both expeditious and economical.

In one of the Southern States there is a large deposit of excellent stone of a kind and grade that is in constant demand. The beds dip into a steep hill. A considerable quantity of the stone has been quarried at the outcrop on the hill slope, but as the work progresses the overburden constantly increases in depth until finally the cost of removing it has become prohibitive. Attempts to remove the stone by tunnelling do not yield good results as there is nothing that would serve as a roof without elaborate timbering. It would seem as if this German method would solve the difficulty, especially as there is a river directly at the foot of the hill that would furnish plenty of water for hydraulic stripping. There are doubtless many other deposits that would find it to their advantage to make trial of this system.

HYDRATED LIME IN CONCRETE

In general it may be stated that the denser the mortar or concrete, the greater the strength, other factors being equal. This fact is, I think, generally admitted. If, then, hydrated lime increases the density, the strength of the mortar or concrete must be increased. The question therefore resolves itself into proving whether or not hydrated lime increases the density.

It is well known that mortars composed of Portland cement and sand are harsh working and non-plastic, that is, they are not easily molded or troweled. These harsh mortars require considerable manual work to mold or to form into any given shape. The addition of hydrated lime overcomes this harshness, rendering the mortar more plastic. It must therefore follow that the same amount of manual labor in molding or troweling will produce a denser mass.

In my opinion, writes E. W. Lazell, of Edwards & Lazell, consulting engineers, Portland, Oregon, in "Concrete-Cement Age," the greatest advantage of the use of hydrated lime is this quality of rendering the mortars more plastic, the increased plasticity resulting in greater density. Exactly the same argu-

ment applies to concrete. Concrete containing a small amount of hydrated lime is much more plastic and smoother working than similar concrete containing no hydrate. Because of this greater plasticity the same amount of tamping would result in a denser concrete.

An illustration of the increase in plasticity of concrete, due to the addition of hydrated lime, recently came to the writer's observation. In the construction of a large dam in the Northwest, the quarry and rock-crushing plant were located on a hillside, about 400 ft. above the river. Since no good grade of sand was available, the fine part of the aggregate was manufactured from the rock. The concrete mixing plant was also located on the hill, above the crest of the dam, and practically all the concrete was spouted into place through chutes about 285 ft. long, which had an inclination of 18°. In this manner about 30,000 cu. yds. of concrete was placed. The concrete used was a 1:3:5 mix, using cement, sand and stone, with an addition of 10% hydrated lime.

is particularly valuable when used in cement mortar, since the affinity of the hydrate for water keeps the mass damp and allows the cement to gain its full strength.

CHICAGO'S LATEST CONCRETE BUILDING.

Among the scores of buildings erected this season in Chicago for commercial purposes, none stands out more prominently than the one at Sixteenth street and Michigan avenue from the plans of Mundie & Jensen, architects, Chicago. The design is one of strict utility, no ostentation or artificiality being permitted at any point.

It was constructed by R. F. Wilson & Company, builders, in record time, the seven floors being erected in seven weeks, using the skeleton Cantilever Flat Slab type of beamless construction, strictly fire-proof and fully equipped for the modern automobile tire trade of the Goodyear Tire and Rubber Co., and is located in the heart of this trade district and on one of the most traveled automobile routes in the United States.



The Goodyear Tire & Rubber Company's New Concrete Building in Chicago. Seven Thousand Barrels Medusa Cement Used. Furnished by Sandusky Portland Cement Co.

Without the addition of the hydrate, the wet concrete would not flow in chutes, but would dam up and then spill over the side. With the addition of hydrate, the material flowed smoothly and there was very little separation of the mortar from the stone. Throughout the construction of the whole dam, test cylinders were made, 6" in diameter x 12" long, and these were broken at regular intervals. These cylinders were made at the site of the dam from the material being deposited. The result showed a considerable improvement both in the quality and the strength of the concrete, due to the hydrated lime.

It is hardly possible, in concrete used below grade, where it is constantly wet or damp, that hydrated lime directly contributes to the bond of the mass, that is, there is probably no chemical combination in which the hydrate plays a part that directly contributes to the strength of the mass. The part played by the hydrate is wholly mechanical, imparting greater density to the concrete. It is further a well known fact that lime paste tends to retain its mechanically mixed water, thus hydrated lime retards the drying out of both mortar and concrete and supplies the water necessary for the full development of the strength of the cement. This quality of hydrated lime

Its grey granite and terra cotta trimmings and wide cornice contrast pleasantly with the soft red tone of the brick, and the rubber tile floors, marble and mahogany entrance leading to swift elevators make a very favorable impression, and give easy access to each floor.

A shipping court in the rear from an alley is served by electric elevators and makes quick deliveries a certainty.

The offices in the rear are on a mezzanine floor over the first story, the show room in front having an extra high ceiling, and being trimmed in circassian walnut, as handsome as the most fastidious can desire.

All dividing partitions are of hollow tile and supplied with art metal and steel doors, and a fire in any room might burn itself out without endangering or damaging the contents of adjoining rooms.

Materials being selected from a strict utility standpoint, Medusa cement was used requiring 7,000 bbls., and had it not been for the excellent service of the Sandusky Portland Cement Co. in making shipments promptly, the record time of erection could not have been accomplished as the storage space at the building was very limited owing to its location on two traffic burdened parkways.

BUCYRUS STEAM SHOVELS FOR GRAVEL AND SAND PLANTS

The Chicago Gravel Company, 343 South Dearborn street, Chicago, one of the largest producers of sand and gravel in the world, recently purchased a Bucyrus 175-B-revolving steam shovel to be operated at their Rockdale (Ill.) pit near Joliet. The shovel has been installed and is working very satisfactorily. The Chicago Gravel Company has a phenomenal bank of sand and gravel which is $1\frac{1}{2}$ miles long and from 25 to 60 feet high. This Bucyrus steam shovel is the first large shovel of this type to be installed in a sand and gravel pit.

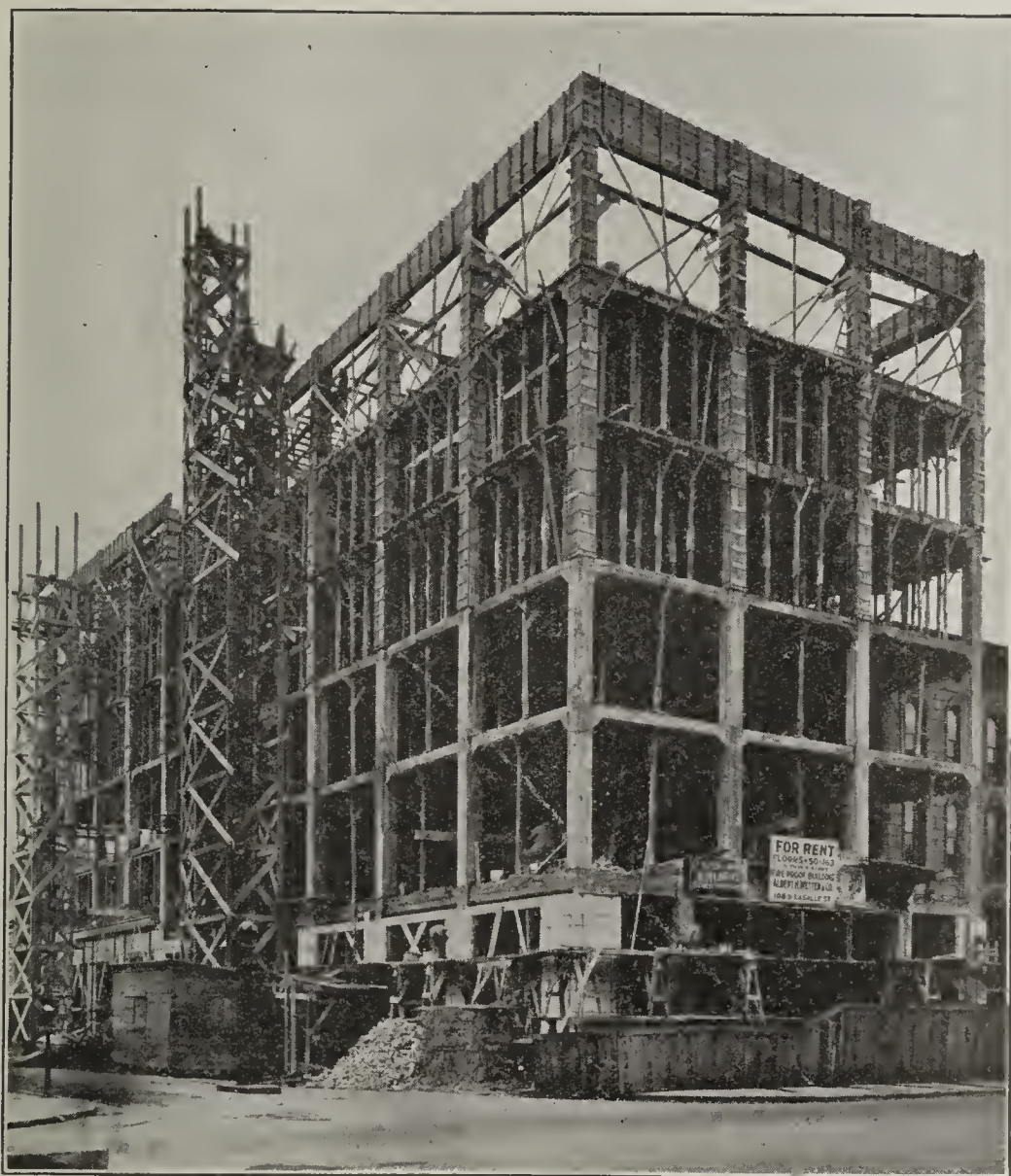
The Atwood-Davis Sand Company of Chicago have just purchased another 18-B-Bucyrus revolving shovel. They intend opening up another sand and gravel pit adjoining their present gravel pit at Beloit, Wis. It is located just across the main line of the Northwestern Railway.

CONTRACTION AND EXPANSION IN A REINFORCED CONCRETE BUILDING.

In order to determine the effect of temperature upon a new building recently constructed in Cambridge, Mass., the Aberthaw Construction Company has had made by Professor Howard of the Massachusetts Institute of Technology, some very carefully standardized measurements of the Gray & Davis five-story reinforced concrete factory, erected by them in 1913, from designs of Monks & Johnson, Boston.

The building is about 381 ft. by 61 ft., the floors being of the mushroom or flat slab type. The outside is embellished with a tapestry brick veneer on corner bays, and also on curtain walls below the windows above the first floor.

The first measurement, made on a sunny morning, November 7th, 1913, showed a temperature on the ground in front of the building of about 70° F., while that on the roof where the upper measurements were



New Concrete Building Under Construction for the Goodyear Tire & Rubber Co.

LIMESTONE FOR SULPHATE USE

E. W. Hough, producer of limestone for open hearth and sulphate use, Ozark, Mich., writes us as follows: Can you put me in touch with parties or concerns interested in dolomite of good quality for sulphite or fluxing purposes? I wish to increase my output and perhaps organize a company to manufacture hydrate for sulphite mills and sand-lime brick industry. Following is analysis made by Algoma Steel Corporation, Ontario, Canada, and Carnegie Steel Company, Pittsburg, Pa., from about 15 samples taken at different locations in the quarry with practically no variation in grade.

Insoluble .56%.

Calcium Carbonate 53.70%.

Magnesium 42.68%.

Iron Peroxide 1.65%.

made, was about 57° F., being in the shade of the parapet wall. Points for measurement were established at the corners of the building by round headed brass screws set into lead expansion shields and well anchored into the concrete wall. Intermediate points, established by stakes driven into the ground at approximately 100 ft. apart, were on the same level as the two end points and exactly in line with them.

Measurements were made three times to obtain averages, and the temperature taken by three standardized thermometers, one at each end and one at mid-length. After making all corrections to the steel tape used, the length was found to be 382.559 ft. at a mean temperature of 69.8° F.

The measurements in the upper part of the building, made from the roof, were located about three feet above the roof level and were set in the same way as

those in the bays. Three separate measurements were made here also, the final length being found to be 379.437 ft. at 56.9° F.

February 12th, 1914, on a cold day following several cold days, three measurements at the base gave an average of 382.552 ft. at an average of 17.4° F. Three measurements on the roof gave a mean length of 379.377 ft. at a mean temperature of 6.2° F.

These measurements seem to indicate that the upper part of the building contracted .06 ft. in a range of 50.7° F.; the base line contracted .007 ft. in a range of 52.4° F.

It is intended to repeat these measurements on a hot day in the summer to further verify the figures already determined.

In addition to direct measurements, vertical lines were established between the bottom and top of the building. The top point at the west end of the building, was found on February 12th to have moved east .02 ft. The top at the other end of the building was found to have moved west .026 ft. Three intermediate points all moved west in amounts varying from .01 to .024 ft. This bears out the generally accepted idea that a building contracts more at the top than at the bottom in cold weather, and correspondingly expands more at the top than at the bottom in hot weather.

LARGE PIPE CONTRACT

The Westinghouse Machine Company reports the receipt of a very important contract calling for the manufacture of 9,800 feet of 36-inch flexible-jointed cast-iron submarine pipe. This pipe is to be used in connection with the New York city water supply, forming a siphon under the Narrows in connection with the water supply brought from the Catskill Aqueduct and carried to Staten Island. The siphon will extend from the terminus of the pipe line from 79th street and Shore road, Bay Bridge, Brooklyn, to the junction of the Arrietta street and Stuyvesant place, Staten Island.

In order to lay this pipe, which will weigh approximately 3,800 tons; it will be necessary to dig a trench across the Narrows, which, on account of the dense traffic, will be a very difficult job, as the specifications insist that no more than 1,000 feet of channel may be obstructed at any time.

Further difficulties in the laying of this pipe are afforded by the tides, currents and great depth of water, and the total excavation necessary.

Experiments made by the city of New York with 36-inch flexible-jointed pipes have proved that such joints are water-tight before, during and after deflection under water pressure up to 2,000 pounds per square inch, and give every promise of being acceptably tight joints without the necessity of submarine calking. This method of stopping joints has therefore been made an extra item in the contract.

In addition to furnishing 3800 tons of submarine pipe, the contract also calls for furnishing over 300 tons of hub and spigot cast iron pipe.

These pipes will be made of cast iron with flexible joints, essential features of which are—the flexible bell turned on the interior, reinforced by a band of wrought iron, set, shrunk or pressed on; a spigot having a tap grooved for the retention of the lead; a narrow turned collar to bear on the bell in order to insure uniform leaded space to carry the weight.

The average laying lengths of the pipes is to be at least 12 feet. The thickness of the metal of the pipe shall not be less than .1 inch less than standard thickness except that for spaces not exceeding 8 inches in

length in any direction, and vary from the standard thickness of .03 inches in excess of the allowance above given shall be permitted. No diameter of any pipe at any place in its length shall be greater or less than the standard diameter by more than 3/16 inches.

The pipe is to be coated inside and outside with a bitumastic solution, or bitumastic enamel. Before the first coat has been applied, each pipe shall be subjected to a hydra-static pressure of 350 pounds per square inch, and to a hammer test under this pressure.

The angle of maximum deflection of the joint is to be 10° 50'.

When the pipe has been finished it will be shipped to New York and loaded on barges from which it will be lowered into the water in sections.

The pipe will be cast at the Trafford City Foundry of the Westinghouse Machine Company, and the machine work, of which there is a very considerable quantity, will be performed at the East Pittsburgh works of this Company.

MAKING CEMENT WATERTIGHT

Extensive experiments are being conducted at the college of engineering of the University of Wisconsin to find a simpler means of making concrete watertight. Results of great importance to contractors, engineers and farmers who have to do with concrete construction are said to have been obtained already, and still more important ones are expected. A large cement company in the Middle West is co-operating with the college by offering the facilities of its plant.

Already some interesting results have been obtained in the effect of the length of the time of mixing in a machine mixer of the batch type; the effect of the percentage of mixing upon the imperviousness of the concrete; the effect of having sand in dry condition before mixing and the effect of having the sand wet.

The experimenters have found that good results are obtained if the concrete remains in the mixer from two to three minutes when dry materials are employed. For cases where the sand and gravel or stone are damp a considerably longer time is required. Therefore the use of wet sand should be avoided if possible. The experiments showed that mixtures consisting of one part cement, one and one-half of Janesville sand of the torpedo grade and three parts of Janesville gravel, when mixed to a wet consistency, are impervious to water when subjected to a pressure of forty pounds to the square inch. Mixtures as lean as one part of cement to six parts of gravel (a graded mixture) have been made impervious at high pressure by using care in proportioning the amount of water and in mixing the batch. The specimens used in making these tests are cylindrical in form and so made that the faces of the cylinders, which are 13½ inches in diameter, are exposed to the predetermined water pressure. The thickness of the concrete through which the water must pass can be varied from four to eighteen inches. Ample provision is made for cleaning both faces of the cylinder before placing it upon the testing apparatus. The apparatus itself is so arranged that very accurate tests can be made.

The importance of these experiments will be more sufficiently appreciated when it is understood that a large proportion of the trouble arising from poor concrete is due to the use of defective sand or gravel.

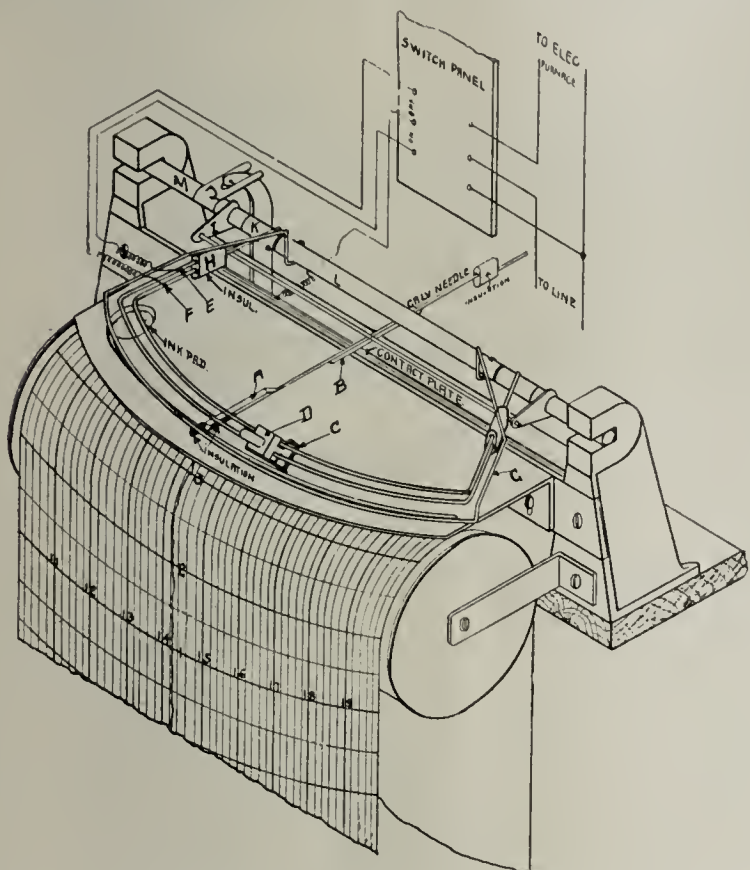
The department is also studying the effect of varying the percentage of cement and water, the graduation of the sand and gravel (by this is meant the size of the rocks and the fineness of the sand), the proportioning of the mixture, the thoroughness of mixing and the effects of different conditions on the hardening of the specimens.

THWING TEMPERATURE REGULATOR

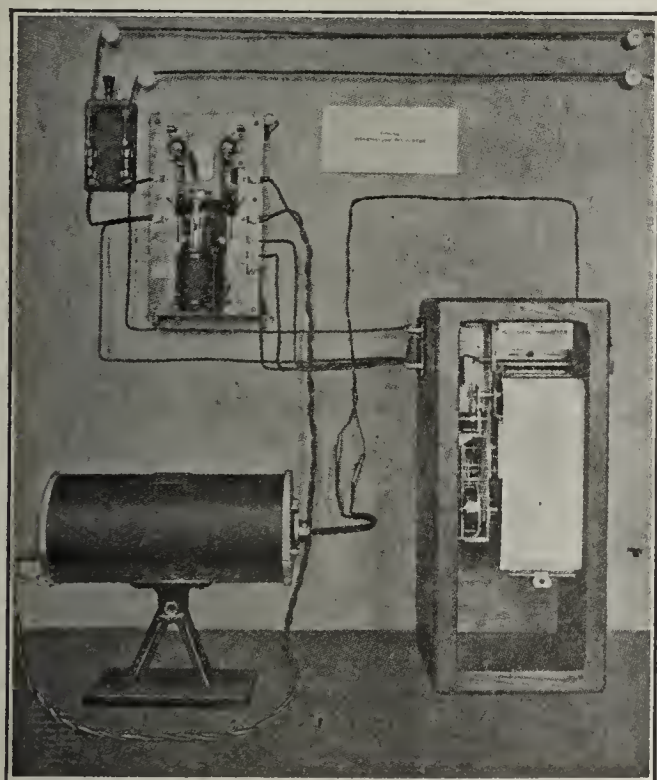
By D. C. Draper*

The electros shown herewith illustrate our temperature regulator, and the diagrammatic view of the principle upon which it operates.

The failure of so many attempts at automatic temperature control in the past, where pyrometers have been employed, has been due to the fact that the actuating current of the thermocouples has been depended upon to free the needle of the instrument from the contact against which the needle has been brought, either at the maximum or minimum temperature



points. This feeble current brought into juxtaposition with the relatively heavier current of the control circuit, has not force enough, after the contacts have been used for a while, to free itself, and the system is a failure. In our apparatus, whether indicating or recording, we do not depend upon the current of the thermocouple to free the needle, but agitate the needle



by means of a depressing lever, so that it springs free from the contact with considerable force, and cannot remain "pitted" against it.

As illustrated in the diagrammatic view, the needle of the recorder is insulated about 1/3 of the length from the rear, so that none of the control current is

allowed to pass through the galvanometer. Thus no coils can be burnt out, and the temperature measuring current is entirely independent of the control current. The capillary film recorder is used, as this permits the placing of movable contacts on the depressor bar, and as the needle is always in circuit with the thermocouple, much more frequent and therefore closer control can be secured.

The needle bears on its point a strip of contact metal, and passes in its movement over a rear contact plate, connected to one of the points on the remote control switch. The primary depressor G brings the needle in contact with the chart, before the contact strip on the needle comes in contact with either of the secondary depressors, on which are mounted the movable contacts. The current is not broken by the needle, but by an auxiliary contact on the clock in the case below, and only 1/10th ampere is allowed to flow through the needle, the balance of the current being handled by a relay. In this way, there is no sparking in the instrument, and absolutely no danger of the contacts refusing to operate.

The mechanism is started in operation with the remote control switch closed, so that the furnace may heat up. The sliding contact D, which bears on its lower edge a piece of contact metal C, is slid along the two depressor arms until it is at the temperature at which it is desired to hold the furnace. This piece of fibre insulates the contact strip C from depressor arm E but not from F, and has a stop at its extreme limit, so that the needle can never swing above C. As the furnace heats up, the needle swings upward on the temperature scale, being depressed by the primary depressor three times a minute, until it is finally depressed under the contact strip C, when a circuit is completed through the contact plate, the needle, the contact strip C and depressor arm F, contact is made by the auxiliary contact on the clock, the switch is energized and automatically opened, shutting off current from the furnace. The needle will be depressed under C two or possibly three times, before the lag of the furnace is sufficiently overcome for the drop in temperature to swing the needle below C, so that it is depressed under E, completing an entirely different circuit, through the contact plate, the needle and E, to the switch, energizing the opposite coil and closing the switch, causing the current to again flow into the furnace, when the operation will be repeated. Inasmuch as the switch is positive in its action, and requires the energizing of one coil to open and of another to close it, the repeated circuits on one side of the switch have absolutely no effect on the operation of the apparatus.

The control is susceptible of extreme closeness, depending upon the range of temperature which must be covered. If it is desired to control temperatures at varying points along a wide range, as from 200 to 1800° Fahr., this would require a crowded chart or scale, and the control could not be as close as though it were desired to maintain the temperature at from 1640 to 1700° Fahr., and a chart or scale covering 50°, 100° or 200° could be provided. In the indicating form, it is usual to furnish the control apparatus separate from the indicating pyrometer, building a much more sensitive galvanometer, and setting the contact points not more than 10° or 20° apart. In this style of apparatus, the depressing mechanism is simpler, because the contacts are not borne on the depressor arm, but are mounted underneath the needle, in the path of its travel, and the depressor arm used as the common arm of the circuit. Any number of these control apparatuses may be mounted side by side in a single case, and the depressing

* Secy. Thwing Instrument Co., Philadelphia, Pa.

mechanism operated by a common motor or clock. The method of adjusting these is to set the zero of the galvanometer by means of an auxiliary indicator, so that the needle will be midway between the two contact points, when the furnace is heated to the desired temperature.

This control apparatus has been thoroughly worked out and tested in actual commercial plants, and is proving a boon to the busy chemist or metallurgist, who can now put his work in the furnace and know that it will be handled at the proper temperature without his attention, which can then be given to other matters. It is applicable not only to electrically heated furnaces, but to oil-fired or gas-fired furnaces. The only difference is that under the last two conditions, a solenoid valve is employed rather than the clapper switch, and if it is necessary to control the air as well as the fuel, this is done by a second valve. These details have been worked out by us in practical usage, and we know that the apparatus will accurately control any temperatures, by electrical means, insuring a perfect product, if perfect materials are used.

THE UNIVERSAL CRUSHER

When a contractor is in need of a stone crusher to utilize waste materials or to prepare his aggregates for construction work or for material used in the construction of highways and roads, the Universal crusher has proven a machine to do such work in a more economical way than with older and more well-known types of crushers in general.

One of the main reasons why the Universal crusher is more profitable is because it is light in weight and can be easily moved from place to place, and requires less power for producing the same amount of crushed rock; its wide range of adjustment by which any size of material can be produced. This adjustment can be made without stopping the machine for an instant or without changing any parts or without the use of any tools whatever.

All parts in the Universal crusher are made of the very best materials that money can buy; all parts are interchangeable and all extras fit to perfection, and all repairs even to the bearings can be made in practically half the time of any other machine known on the market today. Now, this is not idle talk. This machine should be recognized by everyone in need of a crusher and who is ready and willing to investigate the practical features as mentioned above.

The Universal Crusher Co., Dept. 14, Cedar Rapids, Iowa, is well known for its strict guarantee and for its many satisfied customers throughout the United States and Canada. If you take into consideration all these vital points, the prices under which these crushers are sold, you will find you can buy the Universal crusher at an extremely low price. The Universal crusher is counted in the line of the most reliable machines today on the market. You can depend on the price, as the policy of the manufacturer is strict, not allowing any "juggling" of prices whatever, or any cutting just for the sake of deceiving customers.

Every crusher is tested and is constructed throughout with the very best materials, and the buyer runs no risk as every part of the machine which proves defective will be replaced free of charge, f. o. b. Cedar Rapids, Iowa. Another point of great importance is—a Universal crusher after a year's use has the greatest cash value, as in many cases the Universal Crusher Company has agreed to exchange small machines for larger ones on a basis of allowing the full price less 12½ per cent should the machine prove too small after one year's installation. Write the Universal Crusher Co. for their folder No. 10.

CHICAGO BELTING COMPANY

Opening of San Francisco Branch Under Exceptionally Favorable Circumstances

The Chicago Belting Company, manufacturers of leather belting, Chicago, recently opened a branch store in San Francisco, under the supervision of W. M. Shear, assisted by W. A. Daggett and F. H. Kruger, the above three representing the active interests of the Coast Selling Corporation. Also associated with this company are O. C. Hazlett, president of the Truckee Lumber Company, and L. S. Jones, of the Alaska Commercial Company. These two gentlemen lend great influence to the company, although not active.

The opening of this new branch fills the gap that previously existed between this company's branches at Portland on the north and Los Angeles, nearly 1,200 miles south. Those acquainted with business conditions in the West believe that this branch could not have been opened at a more opportune time.

TUBULAR SAND WASHER

Adjustment of the rate of washing sand to the degree of cleanliness is one of the principal aims sought in a new tubular sand and gravel washer which has for its operative principle that of dropping the materials onto shelves and into water as they progress through the length of a cylinder. Lengthwise of the inside of the cylinder are lifting blades set in an angular position. As the cylinder rotates these blades carry the material and water upward, discharging them onto a double series of stationary angle-shaped transverse shelves. The latter retain a certain quantity of the material, which assists in the scouring action and also prevents wear on the shelves.

Materials progress through the cylinder by reason of the arrangement of the shelves over the forward edge of which the particles must pass. Regulation of the rate of forward movement is effected by movement of the lower series of shelves through an adjusting screw, thus, it might be said, changing the pitch. When the lower shelves are set directly beneath the upper ones the progress is slowest and when set with the back upright leg of the shelf under the front edge of the upper shelf the progress is most rapid.

Water passes through the cylinder in the reverse direction from that taken by the material, thus the washed materials, as they tail out, are rinsed in clean water and the primary work of breaking up lumps is done by the muddiest water at the feed end.

The steel cylinder is encircled by steel tires which run on four flanged wheels with chilled treads. Driving gears are placed so as to avoid contact with materials.

The washer, which has recently been placed on the market by the Raymond W. Dull Company, 1912 Conway Bldg., Chicago, is made in four sizes, varying from 36 to 60 in. in diameter, from 8 to 20 ft. long and from 5 to 100 cu. yd. rated capacity. From 5 to 20 hp. is required for operation.

The view shown in their advertisement in Cement & Engineering News gives an idea of the details of the machine.

LINK-BELT CONVEYORS

The Link-Belt Co., of Chicago, Ill., is distributing its Catalogue No. 189, which is descriptive of Link-Belt conveyors for sand, stone, gravel and similar materials. In it, typical installations of the company's machinery are illustrated, among them the portable wagon loader, described in Cement and Engineering News, several months ago. Catalogue is 6 by 9 ins. in size, contains 32 pages and is profusely illustrated.

No Guide Idlers Needed—
Runs True and Even—
No Spillage—

Goodrich LONGLIFE MAXEGON CONVEYOR BELTS

reduce tonnage costs—

The extreme flexibility found in every Goodrich Conveyor Belt gives you a straight running belt which troughs easily, hugs the pulleys and needs no edge-wearing guide idlers. Goodrich Belts won't ride off and spill the load.

Advise us regarding your installations. We make belts for every purpose.



Makers of
Goodrich Tires and
Everything that's Best in Rubber

The B. F. Goodrich Company

Factories: AKRON, OHIO
Branches in All Principal Cities

Goodrich Products

Conveyor Belts	Transmission Belts	Packing
Elevator Belts	Hose — All Kinds	Valves, etc.



There is nothing
in Goodrich Advertising
that isn't in Goodrich Goods



Supremo Conveyor Belt

Adapted for all general requirements such as conveying gravel, cement, clinkers, crushed stone, grain, clay, wood-pulp, salt, tailings, etc. It is far above the so-called standard belt, and one that has given general satisfaction under more than ordinary conditions.

There is a diversified list of uses for Conveyor Belting. We have carefully studied the different conditions and materials and stand ready to construct a belt for the duty to be imposed, which is often of an abusive character. Conveyors for hot cement, hot coke or slag, crushed stone, silica sand, etc., represent a few of the extreme cases.

MANUFACTURED BY

Revere Rubber Company
Chelsea, Mass.

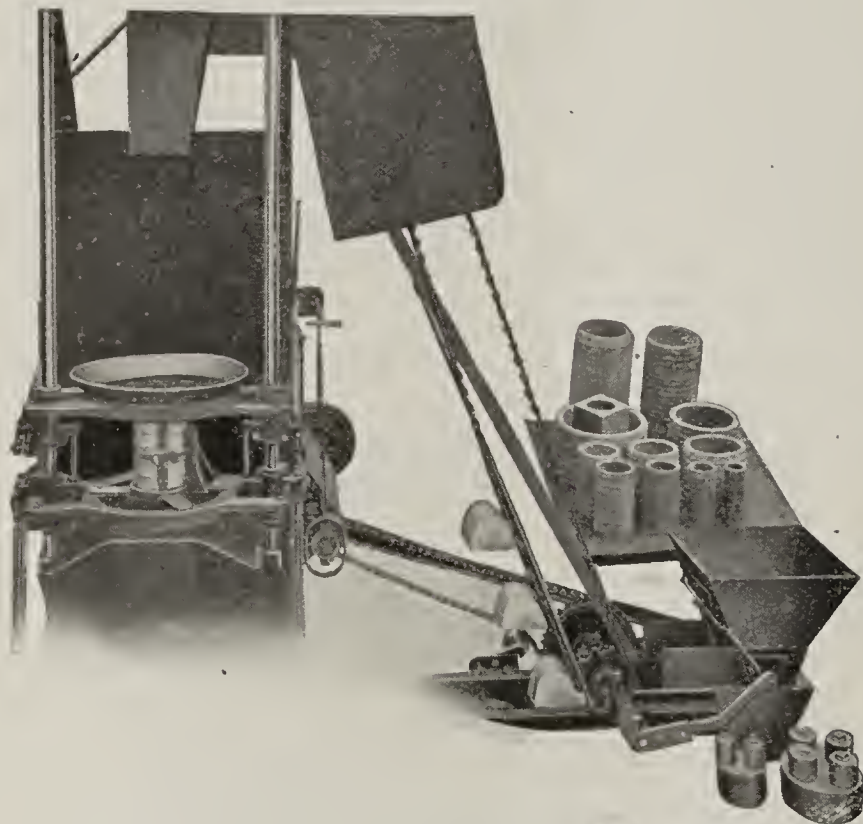


CEMENT TILE

Progressive men in the concrete products business have found the cement tile manufacture a profitable and satisfactory commercial enterprise.

The manufacture of cement tile is pleasant work; no disagreeable and uncertain burning and like operations. It is an exact science compared to the manufacture of clay tile. No guesswork. Cement, which is the active ingredient, is delivered, fully guaranteed and manufactured by concerns whose operations are so extensive that they can employ the highest priced scientific skill, such as individual tile plants could not afford. Manufacturers of cement tile have the best brains of the country behind them.

Tiling is just beginning. It would take one machine a year to make the product necessary to entirely tile one square mile. Cement tile are a staple article. They are always in demand and readily compete with any clay tile in any locality. The accompanying illustration shows a view of the Besser Improved Power Cement Drain and Sewer Tile Machine, manufactured by the Besser Manufacturing Company, 405 Fourteenth street, Alpena, Mich. It is a machine built on principles gained through experience in tile plants. The construction embodies every feature of advantage that perfect mechanical design can de-



Besser Improved Power Cement Tile Machine.

mand. In operation the Besser Cement Drain and Sewer Tile Machine is steady and does not cause delays for adjustments. The machine produces tile in all lengths, including 12 inches, 18 inches and 24 inches, with diameter ranging to 18 inches.

LUTEN TYPE BRIDGES

Daniel B. Luten, of Indianapolis, Ind., is distributing a handsome catalogue illustrating reinforced concrete bridges of Luten design. A brief statement of Mr. Luten's engineering experience and of his qualifications as an engineer forms the introduction to the catalogue, while practically the entire remainder is devoted to photographic reproductions, showing Luten type bridges in various places. Several of these views are printed in colors. In the concluding pages of the book the advantages of concrete bridges are discussed. The catalogue is 12½ by 9½ ins. in size, contains 48 pages, and is printed on an excellent quality of paper.

VAN DUZEN BATCH MIXER

A fine batch mixer is being made and marketed by Van Duzen, Roys & Co., 301 Dublin Ave., Columbus, Ohio. These people have standardized their output by making one size of mixer only, and in that way claim to have made a very close price possible.

The construction of this batch mixer is of a fine quality of steel and iron. The truck is solidly built, and, as the wheels have roller bearings, it can be moved easily. In fact, the mechanism of the whole machine has been reduced to as few working parts as is consistent with good results.

The drum revolves on steel ball bearings on chilled surfaces, and the spindle is so sealed that no dirt or grit can enter. The drum is always open, so that the material being tossed about by the three mixing plows is continually in sight.

This machine is equipped with a 2½-H. P. high-class engine, and makes approximately 1/6 yard per batch, with an average daily output of 50 cubic yards. While the mixer can be operated with a 1½-H. P. engine, builders realize from experience that it is always well to have some surplus power to drive other machinery when necessary.

In this connection, mention may also be made of the fact that Van Duzen, Roys & Co. have also a very simple but efficient hoisting device specially designed for operation in connection with their mixer. It can be thrown in or out of operation very easily, by simple friction, and when not in use, it in no way interferes with the working of the mixer.

We believe our readers will find Van Duzen, Roys & Co., 301 Dublin Ave., Columbus, Ohio, very pleasant people to deal with. Those in any way interested in concrete mixers will do well to obtain this company's free literature before deciding what make of machine to buy.

NEW ARMSTRONG PLANT UNDER CONSTRUCTION

Rapid progress is being made on the new plant of the Armstrong Manufacturing Company, manufacturers of the famous Armstrong blast hole drills, at Waterloo, Iowa. In this day of rather depressed business conditions it is unusual to see \$75,000 being spent for new equipment and buildings. The necessity for this, however, was forced upon the company by the fact that they were not able to take care of their orders in a satisfactory manner in their old plant.

The plan which is being carried out is to keep the old plant running, while the new plant is under construction, tearing down one building at a time. The power plant and boiler room are completed at the present time, and within a few months the new plant will be in running order. The Worden-Allen Company are the contractors.

CEMENT SILOS

A new catalogue issued by the Polk-Genung-Polk Company of Fort Branch, Ind., is entitled "Wind, Lightning, Fire and Concrete." It shows the effect, or rather the lack of effect, of the destructive agencies of nature on Polk silos. Photographs show scenes of destruction following cyclones and fires, with the Polk silos standing undamaged in the midst of the ruins of wooden structures. Another interesting picture shows the negligible effect of lightning on a reinforced concrete silo. Many letters from satisfied users of the silos in all parts of the country put an effective stop to any idea that a concrete silo would crumble or be in any way unsatisfactory. The booklet is a great boost for the concrete silo in general, and for the Polk monolithic silo in particular.

REVIEW OF CATALOGS

Plants for Using Sand and Gravel.—Illustrated, 40 pages and cover 6 $\frac{3}{4}$ "x10". Raymond W. Dull Co., 1912 Chamber of Commerce Building, Chicago, Ill.

A well printed, profusely illustrated description of plants for using sand and gravel, describing in detail conical screens and screens of other designs, scrubbers and sand separators, belt conveyors with tables of calculations for speed capacity and driving power required for these conveyors, elevators, dragline excavators, feeders, portable gravel washing equipment for contractors, etc. This is followed by illustrated descriptions of various plants recently installed by this company.

Concrete in Highway Construction.—136 pages and cover, 6 $\frac{1}{2}$ "x8 $\frac{3}{4}$ " illustrated. Price \$1.00. Atlas Portland Cement Company, 30 Broad Street, New York.

A text book for highway engineers and supervisors containing a detailed treatise on the various uses of concrete in highway construction. It is divided into the following chapters: One, Concrete; Two, Sidewalks, curbs and gutters; Three, Street pavements; Four, Sewers, drain piles, brook linings and conduits; Five, Culverts; Six, Beam bridges; Seven, Arch bridges; Eight, Retaining wall; Nine, Miscellaneous, fence posts, hitching posts, lamp posts, drinking fountains, etc. The book is well written containing numerous and useful tables, sketches and photographs of use to engineers or any one interested in highway construction.

OLD COPIES

Morris Ebert, importer of Mannheimer (Germany) Portland cement, 119 So. Fourth Street, Philadelphia, Pa., writes us that he is going out of the cement business and that he has on file the Cement & Engineer-

ing News complete for the years 1906-1907-1908-1909 1910-1911-1912 and would like to sell them to interested parties.

NEW BOOK—REINFORCED CONCRETE CONSTRUCTION.

The second volume of Prof. George A. Hool's comprehensive publication on "Reinforced Concrete Construction" deals with the subject "Retaining Walls and Buildings" and is a valuable supplement to the first volume which treated the "Fundamental Principles." A third volume will cover "Bridge Design and Construction."

This second volume contains 666 pages, cloth bound, 6 in. x 9 in., the price of which is \$5.00, contains three chapters on "Retaining Walls" and twenty-four chapters on "Buildings," their design, construction and estimating. Outside of some interesting chapters on floor construction, flat slab construction, wearing surfaces and loads, the chapter dealing with column design deserves particular mention, as the author favors the circular hooped column and shows also otherwise good judgment in selecting between safe and unsafe construction.

Detailed plans and specifications are given for buildings with full estimates of the cost, and numerous cuts taken from practice will appear especially valuable to the practical man engaging in reinforced concrete construction. This book will be sent on receipt of price, (\$5.00) by Cement & Engineering News, 1117 Schiller Bldg., Chicago, Ill.

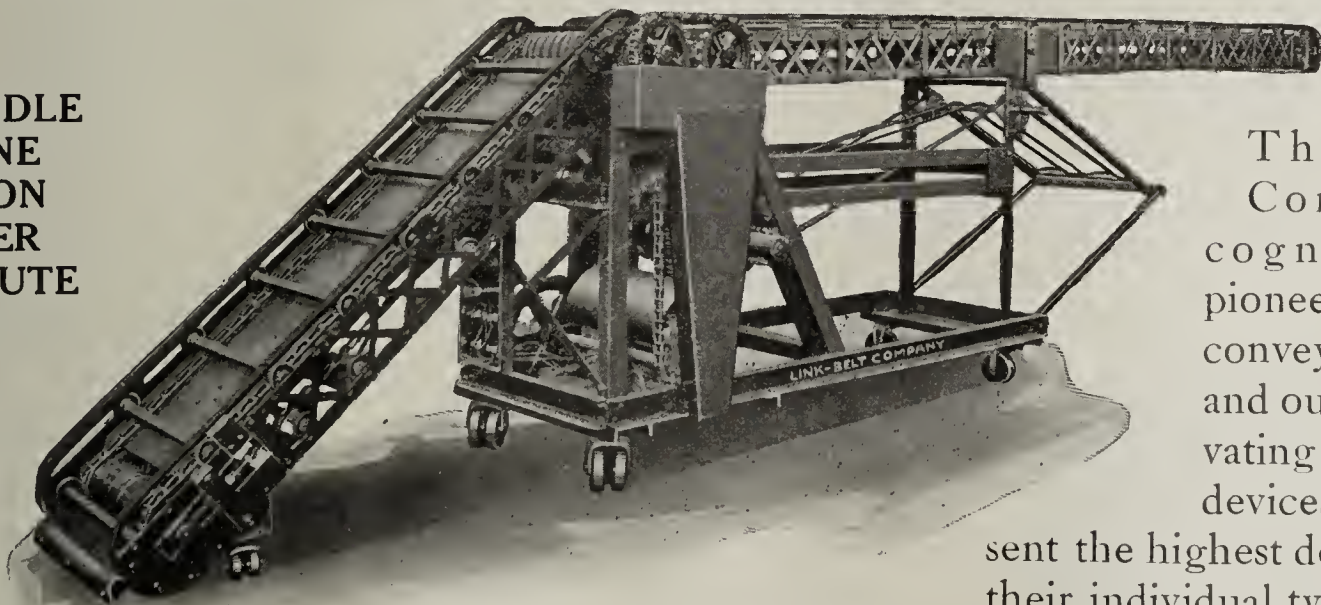
BIRMINGHAM SLAG COMPANY

The Birmingham Slag Company, Birmingham, Ala., use a Model 60 Marion steam shovel also a Model 80 Marion steam shovel. They also use 2 Bucyrus steam shovels, 65 and 70-ton, respectively, and they find that Du Pont dynamite is the best for blasting purposes.

LINK-BELT BAG PILERS

Cut down handling costs and increase the efficiency of your men .

HANDLE
ONE
TON
PER
MINUTE



The Link - Belt Company is recognized as the pioneer in the art of conveying materials, and our various elevating and conveying devices to-day represent the highest development of their individual types.

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Birmingham.....General Machinery Co.
Seattle.....512 $\frac{1}{2}$ First Avenue, S.
Denver.....Lindrooth, Shubart & Co.

San Francisco....N. D. Pelps, Sheldon Bldg.
New Orleans.....Whitney Supply Co.
Los Angeles.....204 No. Los Angeles St.
Detroit.....911 Dime Bank Bldg.

CEMENT DRAIN TILE

That there are wonderful money-making opportunities in the manufacture of cement drain tile is apparent to every thinking contractor who carefully investigates the subject.

The government, the various states, the agricultural colleges, as well as the farm press, are teaching the farmer how to get better results through proper drainage, how to prevent floods and washouts, and how to make a success where heretofore he trembled on the brink of ruin.

The possibilities of drainage are fairly well understood. It is simply a matter of adapting the well known principles to each individual case. The character of the soil, the amount of rainfall and other local features determine what must be done in the way of drainage. In some places the water must be carried away and in other places the land must be irrigated and supplied with the proper amount of water to insure the best crops.

The manufacture of drain tile has heretofore been largely in the hands of the burnt clay manufacturers. The larger the plant the cheaper they could turn out the tile, but the saving to the farm was absorbed in freight rates on even a comparatively short haul. Then too, a stock had to be carried in the local yard or there was a probability that the right sizes could not be obtained in sufficient quantities when needed.

The introduction of cement drain tile has changed the situation materially. By the use of modern machinery the contractor is also to make any required size and supply them to the farmer or other contractors on comparatively short notice. He can set up his machine wherever it is handiest to operate, whether at the gravel pit, in his yard, or at the place the tile are to be used.

The W. E. Dunn Manufacturing Company, 4139 Fillmore street, Chicago, Ill., have designed a machine which is practically automatic in its operation.

A variety of sizes are made from three to sixteen inches in diameter. The simplicity of its operation is such that it can be operated entirely by one man, while its durable construction makes it a most permanent piece of the carpenter's equipment. The capacity of one of these machines is limited somewhat by the skill of the operator, but the manufacturers claim that it is possible to turn out from 3,000 to 3,600 perfect tile per day.

The Dunn Drain Tile Machine is made in a number of styles and sizes so that the contractor can select one which will give him the best results. Those who are in doubt as to the good qualities of the machine are given an opportunity to test them on a fifteen days' free trial, which should be long enough to convince the most skeptical whether or not it is the machine for their use.

The complete catalog, thoroughly covering the subject of cement drain tile manufacture, can be secured by our readers from the manufacturers direct.

CONTRACTORS' SUPPLIES

Catalog No. 11 of the Lansing Company, 747 Cedar St., Lansing, Mich., contains descriptions, prices, etc., of practically every piece of equipment and device needed by the building contractor. There are wheelbarrows, carts, trucks, scrapers, wagons, turn tables, as well as machinery, such as hoists, continuous and batch mixers for mortar, concrete and plaster.

This handy catalog will be of interest to our readers as it will post them on the prices of equipment which they need as well as allow them to select the particular styles which they can use to the best advantage.

NEW HYDRATED LIME PLANT

The United Lime & Stone Co., Harrisburg, Pa., have retained Richard K. Meade, Chemical, Mechanical and Industrial Engineer, 202 N. Calvert Street, Baltimore, Md., to prepare plans and specifications for their new hydrating plant at East Lemoine, Pa. This will be modern in every way and when completed will be one of the finest hydrated lime plants in Pennsylvania. It will have a capacity of 40 tons of hydrate per day. One of the features of the plant will be six large curing bins each designed to hold 24 hours run of hydrate. Mr. L. R. Spong, the general manager of the United Lime & Stone Co., is a great believer in perfect hydration and these bins are designed to give the lime plenty of time to absorb all of the water necessary for this. Mr. Spong reports the business of his company now more than they can accommodate and hence the new plant.

The new hydrated lime plant of the Dutchess County Lime Co., Dover Plains, N. Y., is now nearing completion. Work was begun upon this last fall but owing to the severe weather in January, February and March in this section the plant could not be completed at as early a date as was contemplated. The plant will have an initial capacity of 75 tons of hydrated lime per day and is so arranged that this output can be doubled without making enlargements of the building necessary. The plant is also provided with a Bradley pulverizing mill, manufactured by the Bradley Pulverizer Company, Boston, Mass., for the manufacture of pulverized limestone for agricultural purposes, etc. The output will be sold through the Palmer Lime & Cement Co., New York City. Richard K. Meade, Chemical, Mechanical and Industrial Engineer, 202 N. Calvert Street, Baltimore, Md., is the engineer and prepared the plans and specifications for the new plant. Mr. Ambrose Allen, Dover Plains, N. Y., is the superintendent of this plant and the construction is being done under his supervision.

GOODRICH PERFECTS NEW DREDGING SLEEVE

Makes Important Improvement which Minimizes Expansion to Greatest Degree

An important improvement in dredging sleeves has been made by The B. F. Goodrich Company, at its factories at Akron, Ohio.

A fabric of special design has been used in the solution of the expansion problem in dredging sleeves and the new Goodrich sleeve, as perfected, reduces expansion to an absolute minimum.

The durability of dredging sleeves, no matter how good their other features, can be seriously impaired by excessive expansion.

This difficulty has been largely done away with by this improvement in fabric construction, which has been applied to both Pinnacle and Goodrich grades.

The improvement will apply to general engineering where the dredging sleeve is an important item.

LIMESTONE PRODUCTS

The American Lime & Stone Company who have four quarries in various cities in Pennsylvania having a daily capacity of 2,500 tons, advise us that they are using Jeffrey pulverizers and Cyclone well drills and Du Pont dynamite exclusively and they are well pleased with these products as they never have any trouble with them and they can always be relied upon.

Lansing Broncho Batch Mixer

\$200 and
up.

Sizes 7 to 10
15 Cu. Ft. Capacity



Better Than the Best

Only costs a fraction as much.

New 1914 Models

Here's the new 1914 Model Lansing Broncho—"The Daddy of All Mixers." A strong, powerful mixer that is better than the best and only costs a fraction as much. Not a cheaply made machine at a cheap price; but a high grade, first class mixer at popular price. A machine every contractor will be proud of. Strong where strength is needed. High wheels for easy moving; low intake for quick, easy loading, high discharge for wheelbarrows or forms. Easily cleaned; quickly and easily moved. Equipped with all of the latest and most modern devices, and built on the most modern and sensible lines, combining few wearing parts with great strength and speed.

**No Other Mixer
Combines all of These Features**

Low charging for wheelbarrows or shovels. Measuring hoppers for those who want them. Side loaders for big jobs; high discharge for wheelbarrows or forms; simple, strong, powerful engine; non-slopping rings; quick mixing principles; ball and socket fifth wheel for short turn, and to avoid racking of frame on uneven ground; few wearing parts for economical up-keep; high wheels for hauling steel drum; machined bearings; steel channel frame; friction clutch for starting and stopping; quick mixing, cleaning and dumping principles. Most mixers have some, but the Broncho combines all of them—the most satisfactory machine made from every required standpoint.

**1914 Models Are Marvels
of Strength and Speed**

They produce a quality of mix that every inspector accepts and pronounces *good*, doing it at most satisfactory rate of speed—600 batches and over per day, if required. Discharge operated instantly without the usual slopping. Mixer is reinforced, braced and strengthened at every possible wearing point. Machined track and bearings; channel iron frame (cross and corner braced), insuring the longest possible life and greatest wear. Designed to carry loads of from 1,000 to 5,000 pounds of concrete every batch, 10 hours a day, and 365 days in the year. Adopted by the largest and most exacting contractors in the country.

We Also Manufacture

Continuous Mixers
Mortar Mixers
Hand and Power Mixers
Block & Brick Machines
Ornamental Moulds
Tools Barrows Carts
Scrapers Sand Screens
Mortar Hods
Mortar Trays, etc.

Send for Catalog

The Lansing BRONCHO is Truly the Biggest Value Ever Offered.

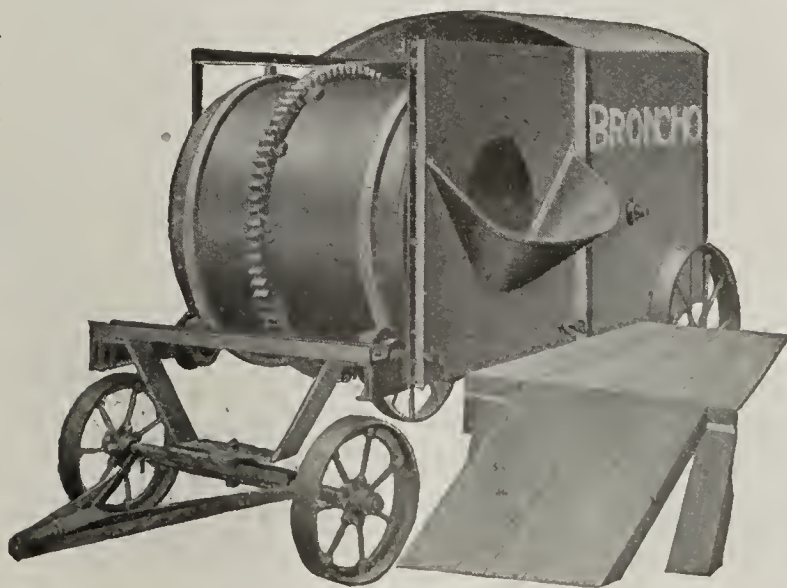
You don't buy mixers every season and you don't have to with the Broncho. Every dollar saved in equipment is so much more profit, and profits are what mixers are built for. Why invest in a cheaply built machine when you can get a well built, long wearing, well designed machine at the same price? Don't be content merely with a cheap mixer, but get a good mixer at a low cost. Do not invest a dollar in a concrete mixer until you have learned more about the Lansing Broncho. It is truly the biggest value ever offered in good machinery at low prices.

LANSING COMPANY

747 CEDAR ST. LANSING, MICH.

Branch Houses

New York Boston Philadelphia
Chicago Minneapolis
Kansas City San Francisco



Among The Cement Mills

Louisville Cement Co.

The Louisville Cement Company, Louisville, Ky., filed amended articles of incorporation in the County Clerk's office yesterday increasing its capital stock \$100,000, making the total \$850,000. The extra \$100,000 increase will be preferred stock and will be sold to employees of the company at \$100 a share, which stock is to bear 6 per cent interest. The stock will be in three classes. Employees receiving \$1,000 a year or less will be entitled to purchase as many as five shares of stock. Employees earning \$2,000 a year and not over that amount will be allowed to purchase nine shares of stock. Employees earning in excess of \$2,000 a year will be allowed to purchase nine shares and one additional share for every \$500 above \$2,000 a year they earn.

Cement for Hawaii

Two thousand tons of cement to be used by the government in the construction of a drydock at the Pearl Harbor fortifications, Hawaii, will be loaded in Seattle by the steamship Honolulu, operated by the Matson line in the Seattle-Hawaii-San Francisco trade. The Honolulu will arrive in port early tomorrow morning. The first drydock built at Pearl Harbor went to pieces because of insecure foundations. The dock was built under contract, but the new one will be constructed by the government.

Inauguration of work on the new lock has been held up pending an investigation of the site by United States engineers. The shipment of cement is taken as an indication that the government is ready to go ahead.

New Cement Mill

The contract for construction of machinery to be installed at Plant No. 7 of the Universal Portland Cement Co., now building at Duluth, Minn., has been let, part to the Allis-Chalmers Mfg. Co., Milwaukee, Wis., and part to the Vulcan Iron Works, Wilkes-Barre, Pa. The equipment consists of four 150-ft. Vulcan kilns, 15 7-ft. tube mills and eight dryers. All gearing on this equipment will be cast by the Stroh Steel-Hardening Process Co., Pittsburgh. Four No. 2 Sturtevant Duplex Ring-Roll Mills, capacity 80-90 bbls. per hour each, to 20 mesh with 80 h. p. also 9 No. 3 Sturtevant Newaygo screens and eight No. 1 open door rotary clinker crushers, all furnished by Sturtevant Mill Company, Boston, Mass., will be installed in this new mill.

Texas Cement Companies

The so-called cement anti-trust suits were settled late yesterday afternoon at Austin, there having been four companies against which the state instituted suit in the Twenty-sixth district court. An agreed judgment was taken against the Southwestern States Portland Cement company of Dallas, and the Southwestern Portland Cement company of El Paso in favor of the state for \$15,000, and costs of prosecution.

The suit as to the defendant, the Texas Portland Cement company of Dallas, was dismissed for the reason that this company since the filing of the state suit has gone into involuntary bankruptcy. The other defendant, the Alamo Cement company of San Antonio, was given judgment in its favor, the evidence failing to connect it with any unlawful combination.

THE BISHOP PATENT DERRICK EXCAVATOR

FOR HANDLING SAND, DIRT, GRAVEL, CRUSHED STONE, ETC.

There are only two machines that will dig material that is met with, and they are the steam shovel and the dipper dredge. By using the Bishop Patent Excavator, any derrick having a rectangular or a square boom can be converted into a steam shovel or a dipper dredge made out of a derrick boat.

This apparatus can dig anything a steam shovel will dig, and

its range is from the base of the derrick to the end of the boom and below the base of the derrick the length of the dipper arm.



WHY KEEP AN EXPENSIVE

steam shovel at work at the pit excavating sand and gravel when lower-cost equipment will do the same work? With your regular derrick you can dig material from the bank, you can excavate earth, you can handle loose materials on the construction job.

The Bishop Patent Derrick Excavator is an attachment that is readily adjusted on your derrick. It consists of a carriage traveling on the boom, a dipper and a dipper arm. A square or rectangular derrick boom, a double-drum engine and swinging gear are required. One man operates the equipment.

UNION IRON WORKS

HOBOKEN,

ERIE SIDING,

NEW JERSEY

These two companies against which judgments were recovered are perpetually enjoined from respecting or carrying out any combination or agreement between themselves or the Alamo Cement company or Texas Portland Cement company to fix the price of cement within this state. The companies are further perpetually enjoined from hereafter entering into or making any combination or agreement with themselves or any other concern to fix the price of cement in Texas.

At the present time a trustee's sale of the properties of the Texas Portland Cement company, is being advertised as a step in the federal bankruptcy proceedings. The minimum amount asked for the property is \$1,000,000.—Dallas Times, April 30.

Commerce Commission Blocks Proposed Cement Rate Boost

Increases in freight rates on cement ranging from one to two cents a hundred pounds, proposed by railroads operating throughout the middlewest and northwest, were suspended today by the interstate commerce commission until July 30. The proposed advances average about fifteen per cent.

Dust Collecting

Jamesville, New York, was promised last night that the annoyance created by the discharge of dust from the plant of the Thomas Millen Cement Company in that village would be stopped.

Robert Love, general manager of the company, appeared before a meeting of the Jamesville Business Men's Association and explained the workings of a dust collecting device which he said his concern was willing to install at the close of the present season.

According to Mr. Love the new device will cost \$20,000, it being necessary to construct a separate building in addition to the present plant to house it. When it is in operation it is said the new apparatus will collect and solidify all the cement dust which is constantly being "blown off" at the plant and of which the villagers have made complaint.

The attitude taken by the cement company was satisfactory to the business men and they agreed to withhold any action pending a trial of the apparatus.

Brings Suit

The Dixon Pure Ice Co., Dixon, Ill., has started suit against the Sandusky Portland Cement Co., Dixon, Ill., and the case will be tried next week. The ice company asks damages which it alleges are caused by the large amount of water which is heated daily by the cement company and which is alleged to have destroyed the ice field of the above mentioned ice company.

The bill alleges that the ice company has been greatly damaged and 25,000 tons of ice and a profit of \$25,000 could have been made had it not been for the immense quantity of hot water flowing through the ice field.

Two Big Steel Contracts

The Russel Wheel & Foundry Company, of Detroit, has completed the erection of the rebuilding of the power house for the Huron Portland Cement Company at Alpena, Mich. The company is also working on the fabrication of the steel for the addition to the power house and conveyors for the Michigan Lime Stone and Chemical Company at Calcite.

THE NEGLEY PATENTED EXCAVATOR

PERFORMS ALL SLACK CABLE-WAY OPERATIONS WITH EFFICIENCY AND ECONOMY

NOTICE—Our Excavator is protected by U. S. patents Nos. 1,053,428 and 1,086,304, Canadian patent No. 151,915 and other applications are pending. Infringers will be prosecuted. We request manufacturers and purchasers to respect our rights. We have already been compelled to bring suit against several firms for infringement of our patents.

INDIANAPOLIS CABLE EXCAVATOR CO., NEW YORK ST. and BEAUTY AVE., INDIANAPOLIS, IND.

LELAND EQUIPMENT COMPANY, 126-128 Pine St., San Francisco, Calif

Agents for Arizona, California and Nevada

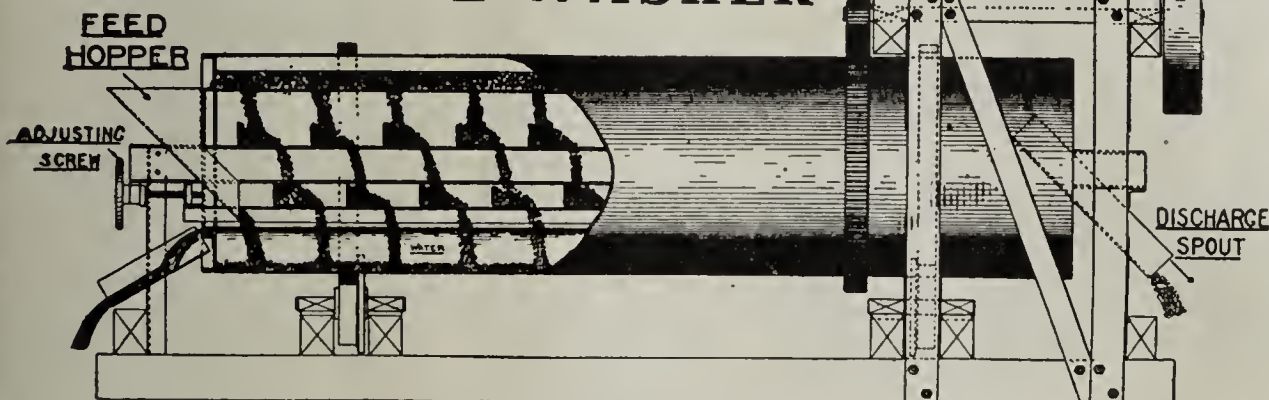
CHAS. T. TOPPING MACHINERY CO., Bessemer Bldg., Pittsburgh, Pa.

Agents for Western Pennsylvania and West Virginia



The above cut shows our excavator at work in Iowa. The buyer is so pleased that he refers to it as the cheapest loading proposition he ever handled.

DULL IMPROVED TUBULAR GRAVEL WASHER



The drawing above gives a general idea of the design of the Dull Improved Tubular Washer. The operative principle is that of tumbling the materials about in a bath of water as they progress through the length of the cylinder.

DRIVE PULLEY

Convert Bank Sand and Gravel into A 1 Concrete Material by Washing It Yourself

A durable washer for contractors' use. Produce your own clean aggregates.

Dull Improved Tubular Washers are built regularly in diameters from 30 to 60 inches with lengths of 8 to 20 feet.

A Special Booklet Sent on Request

THE RAYMOND W. DULL CO.

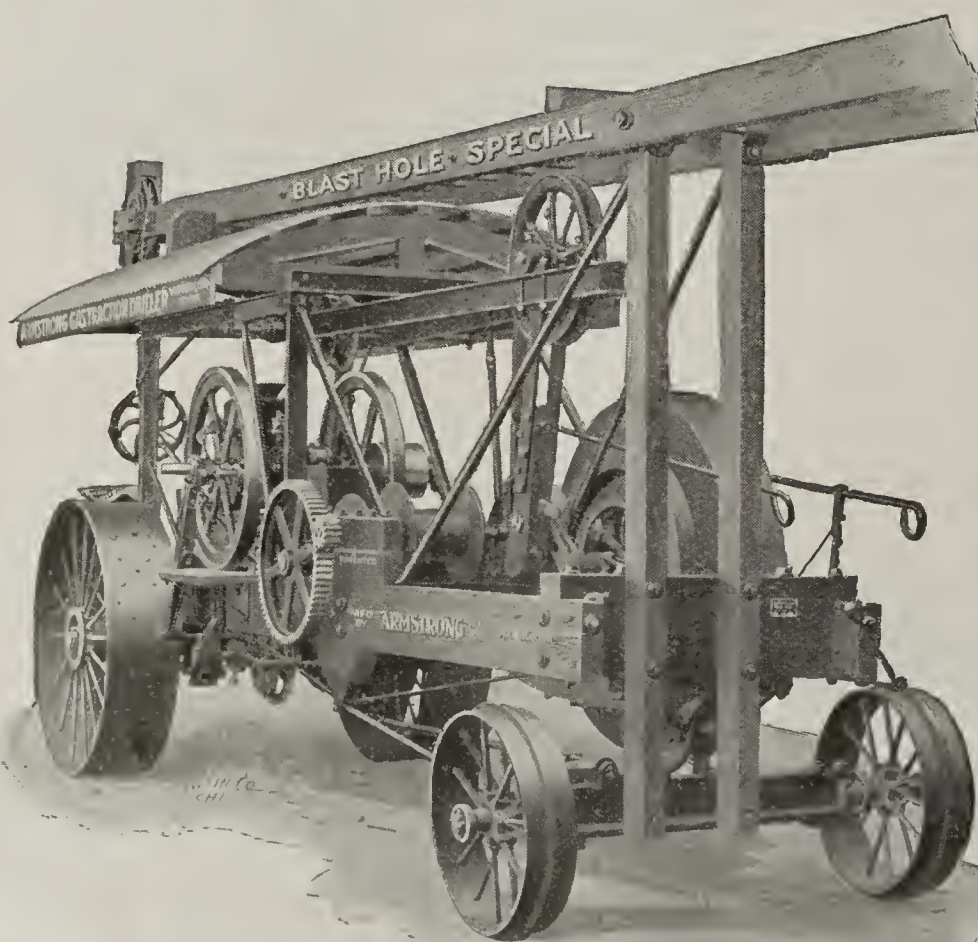
1912-1914 Conway Bldg., CHICAGO



A Well Drill Is Not



A Blast-Hole Drill



THIS is an age of specialization—contractors and quarry operators who use Armstrong Special Blast-Hole Drills do so because the "Armstrong Special" is designed exclusively for drilling *blast holes—not wells.*

"Armstrong Special" Blast-Hole Drills are not well drills. We have built well drills since 1867, and we know, as do scores of successful contractors and quarry men, that well drills are not designed for and will not stand the grief of blast-hole drilling. A comparison of machines which have been in operation for a reasonable period of time will convince you. Behind our knowledge is fifty years of drill building experience—behind the experience of users is the knowledge that Armstrong machines are not only more efficient, but the repair, operating and upkeep expense is less due to the fact that

The "Armstrong Special" Blast-Hole Drill Is the Only Cable Blast-Hole Drill Designed Exclusively for Blast-Hole Drilling.

That is why it accomplishes more for the contractor and quarryman than any machine of any other type.

Every working part of the "Armstrong Special" Blast-Hole Drill is designed with direct reference to hard-rock drilling. The Armstrong spudding beam—the most important feature—gives a quick, sharp, springy blow that drills more hole at less cost than any other. The Armstrong raises the tools as fast as they drop and *does not allow the tools to rest at the bottom of the hole* as in the case of well drills.

Judge for Yourself

If we can prove to you that the *Armstrong* will drill blast holes cheaper and better than any other machine, you surely want to know it. All you have to do is to send a postal asking for proof of "Armstrong Special" Blast-Hole Drill superiority.

Armstrong
Mfg. Co.

Waterloo, Iowa, U.S.A.

Eastern and Export Office
11 Broadway
New York City

Western Branch
3rd and San Pedro Streets
Los Angeles, Cal.

Canadian Branch: Drinkle Block No. 2, Saskatoon, Sask.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

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the 5th of the next month, to avoid missing the next number.Advertising copy or changes in ads. must be in this office by the 25th of each
month, as hereafter our magazine will appear on the 5th of the following month.

Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, JULY, 1914

THE HARDENING PROCESS OF HYDRAULIC CEMENT

For a number of years comparatively little has been added to our knowledge of the hardening process of hydraulic cements. The interpretation of the hardening given by Michaelis has been so lucid and has been verified by so many experimenters that the colloid theory requires no further support.

Michaelis, the originator of the colloid theory, reasoned that a pure process of crystallization, as in the case of the hardening of gypsum, can never cause hydraulic hardening. Gypsum is not a hydraulic mortar, although the crystals composing hardened gypsum are nearly insoluble. A conglomerate of crystals, therefore, no matter how insoluble they may be, can never give rise to impermeability. Crystals have plane surfaces and leave voids between them, which invariably admit water. The cause of the impermeability of hydraulic cements, therefore, had to be looked for in a different medium and was found by Michaelis to be the colloidal bodies forming mainly from the silica and lime compounds of the burnt cement.

All that has been added since by later experimenters consists of discussions and explanations of microscopic preparations made with a view to study the chemical composition of the colloids and crystals observed in cement. Thus Rohland, Ambroun, Becker and Kaisermann published in succession valuable illustrations of the working of the colloids in hardening cement. The last-named observer's researches were published in this magazine in January, 1911. Our readers will possibly recall that Kaisermann worked out a novel process of staining his preparations which proved very valuable in distinguishing the chemical compounds formed and in telling which elements took part in forming crystals and which constituted the colloidal ground mass in which the crystals were imbedded.

A recent essay by Dr. F. Blumenthal has been conducted along similar lines and furnished about the same results. The author attributes the setting of cement, that is to say the immediate process of taking solid form of the liquid mortar, to the formation of crystals, mainly composed of alumina compounds, and the hydraulic hardening, that is to say the process

of becoming impervious to water, to the formation of colloids principally composed of calcium silicate.

Dr. Blumenthal's publication, which is accompanied by numerous illustrations of microscopic slides, will be submitted to our readers in one of our next issues, namely, as soon as we can obtain a translation from the German original.

1915 CEMENT SHOW

Announcement has been made by the Cement Products Exhibition Company, 208 South La Salle street, Chicago, that the Eighth Annual Chicago Cement Show will be held in the Coliseum, February 10-17, 1915. February is looked upon as the most advantageous season for the show. It has been found that contractors, engineers and cement users are able to attend the exhibition in that month and it is the time when the maximum amount of purchasing and specification of equipment and supplies is done.

Only one Cement Show will be held in 1915. The time has been shortened and arrangements have been made to give the exhibitors more time both in installing and removing exhibits. The management of the Chicago Show is confronted by the problem of finding enough space to accommodate all the exhibitors who seek representation. At the show in February of this year, every square foot of available space, both in the main building and the Annex, was leased long before the opening. About seventy-five manufacturers who desired to exhibit filed their applications too late to obtain reservation. The use of the Coliseum balcony and the Seventh Regiment Armory was seriously considered for a time. The idea was abandoned, however, owing to the inaccessibility and excessive cost of putting these places in condition for displays. No satisfactory solution of the problem of too little space is in prospect. The policy of allotting floor space to the earliest applicants will be followed in connection with the next Cement Show as has been the case in the past.

A new floor plan has been developed which, it is believed, will meet with universal approval. A greater number of spaces will be provided and it will be possible to give the main avenues an attractive appearance. A uniform installation plan, without high partitions, will be adopted. The management will again prepare the exhibit spaces so that no attention on the part of the exhibitors will be necessary other than to place their exhibits in position.

It is expected that the floor plans, application blanks and complete information will be sent out from the offices of the Cement Products Exhibition Company to the list of prospective exhibitors not later than August 1. An early drawing for space will be held. After assigning the space the remainder of the year will be devoted to the advertising of the show and the promotion of a big attendance of engineers, architects, dealers, contractors, builders and cement users.

MEDUSA WATERPROOFING PATENT
SUSTAINED

In the United States District Court, Northern District of Illinois, on February 13, 1914, a decree was entered declaring the Newberry patent, No. 851247, to be good and valid, and that the McCormick Waterproof Portland Cement Company and S. T. Sjoberg infringed said patent and are perpetually enjoined from making or selling waterproof cement or carrying on the process described in said patent, and that the complainant shall recover the damages resulting from said infringement.

Suits against other infringers have been begun and will be vigorously prosecuted.

The Decorative Possibilities of Concrete

By C. W. Boynton and J. H. Libberton

In the early days of construction, the architect and engineer appeared on the work under the title of master-mason. This individual wore long robes as an indication of his authority, and the designs on his trestle board are a matter of history. With the pass-



Fig. 1. Chicago Postoffice, West Front.

ing of the master-mason came the architect and engineer, the one a worker in lines, and the other a worker in figures.

The combination is ideal; one specializing on beauty and the other, safety and efficiency. Too often, however, safety and efficiency receive first consideration, and the beauty only gets its share after costs have been carefully calculated.

In reality, the most common buildings of a manufacturing type can be made to conform to pleasing lines without the additional expenditure sometimes thought necessary. After pleasing lines have been determined, then comes the question of decoration. In many instances this is carried to extremes and we find exquisite examples of stone carving and cornice work being placed at the top of an eighteen or twenty-story office building, which no one can see or appreciate except a possible few located in offices upon the opposite side of the street.

This may be said of the Chicago postoffice (Fig. 1), with the exception that here the entire structure has been injudiciously placed. It is well recognized that a structure of this kind occupies a maximum ground

area with a minimum return in floor space and light area. This building was a large undertaking from an engineering standpoint, but whether or not it is an architectural success few may judge because of the impossibility of viewing the entire building at one time. Of the same type is the Capitol at Washington, but so judiciously has it been placed that a full view may be obtained from all sides without obstruction. In the open, or upon the crest of a hill, the Chicago postoffice, even though inefficient in design, would be architecturally beautiful.

There is an old maxim to the effect that the designer should ornament his construction and not construct his ornamentation. This is an admirable saying, but should be subordinated to another rule, that he should ornament his structure only if he lacked the skill to make it beautiful in itself. A structure of any kind that is intended to serve a useful end should have the beauty of appropriateness for the purpose it is to serve. It should tell the truth, and if the character were such that it can be permitted to tell the whole truth, so much the better. It should preferably be beautiful and not beautified.

There is a certain charm about a massive structure almost irrespective of design. The sight of a pyramid on the desk would call forth no expression of interest or enthusiasm, but let this grow in size until it assumes the proportions of those famous structures of Egypt and many pilgrimages will be made to view it. Of course the Egyptian pyramids are assumed to be the resting place of kings, and the placing of the blocks required the use of more muscle or machinery than we at present have any knowledge of, but our



Fig. 2. Detail of Unity Church, Oak Park, Ill.



Fig. 3. Concrete in the Administration Building and Balustrade, Washington Park, Chicago.

idea of their beauty and grandeur obtains primarily from the immensity of the structures.

There is no reason, however, why mass should not be combined with decoration, provided the design is not made subordinate to the decoration. This combination has often been used very effectively. The question is, what medium shall be chosen? At the Unity Church, Oak Park (Fig. 2), the building is not only monolithic concrete but the ornamentation partakes of the same characteristics, having been cast at the same time and of the same material. In a building of this type, however, much attempt at decoration would be fatal and the unobtrusive style adopted de-



Fig. 4. Entrance Detail, Administration Building of the South Park Commissioners, Washington Park, Chicago.

tracts not in the slightest from the dignity obtained by large areas and massive construction. With a different style of building, such as the Administration Building at Washington Park (Fig. 3), the treatment may be entirely different and the concrete be called on to assume the most intricate shapes.

Both of these buildings show the same surface finish. The architecture determines the decoration. With conditions reversed and the decorations transposed, the effect would be ludicrous. In these buildings the monotony of the form concrete has been relieved by the use of a rather dry surface mixture which discloses the nature of the aggregate used. In work of this kind, particular attention must be paid to methods of obtaining uniformity of surface and absence of horizontal joint markings (Fig. 4), although the latter blemish is not nearly so noticeable on work of this character as with the wet mixture.

After all, the question of pleasing effects depends not only on the surfaces and the surface treatment, but on the combination of design with the surface texture. Compare, for instance, the factory of the Carter's Ink Company with that of the Piqua Hosiery Company (Fig. 5). Both have been finished with the same tools but the former shows infinitely more work without obtaining a pleasing effect. The difference



Fig. 5. Manufacturing Building of the Piqua Hosiery Co., Piqua, Ohio.

seems to lie mainly in the appreciation of the possibilities in a molded material. A number of large surfaces have been substituted for the cut-up stone effect and the judicious use of the bush hammer has accentuated the massive and graceful design of the building (Fig. 6). And this effect has been achieved without any expensive decoration or form work other than would be required for the most simple structure of reinforced concrete. On a smaller building, such as a subway entrance in Boston (Fig. 7), the method of dividing off the panels is more pleasing, possibly because the proportion of small areas to the whole is so much greater. Nevertheless, you will agree that the method of treatment used on the Piqua building is even superior on a small structure, such as the Weston Fire Station (Fig. 8), where also the panels have been bush hammered, preserving the corners and margins intact. Consistent with its purpose, the entire structure is of reinforced concrete.

When not carried to extremes, the judicious use of a few division marks, such as have been employed by

the Witherbee Sherman Company in its power station (Fig. 9), relieves the plainness of design and forms a rather interesting framework for what would otherwise be a monotonous surface. Had the block surface been carried across the entire wall, the pleasing effect would have been ruined.



Fig. 6. Detail of Entrance to the Building of the Piqua Hosiery Co., Piqua, Ohio.

No doubt everyone is familiar with what seems to be the proverbial small town water supply tank, with its hemispherical bottom and sprawling legs; anything but an ornament in the community. This same type of structure was installed at Gary Indiana (Fig. 10), but so well has it been concealed that the tower is a thing of beauty and possesses real architectural merit. The work of molding so large a structure in reinforced concrete was greater because of the forms required, the total height being 125 ft. But the finished structure justified the labor. The lower 25 ft. and the upper cornice are of cast concrete stone, made



Fig. 7. Subway Entrance, Boston.

by George Rackle & Sons of Cleveland. The remainder is of reinforced concrete. The relief for the surface monotony is seen in the decorative work at the top and base.

Decoration, however, is not an essential of mass construction, as has been clearly demonstrated by the Spanish in the design of the adobe dwellings and missions. But adobe perishes and our interesting relics of former days will soon be a thing of the past. Not-



Fig. 8. Weston Fire Station, Weston, Mass.

ing the possibilities of monolithic concrete for preserving this architecture, Frank Miller has undertaken to petrify indefinitely, as it were, some of the most interesting details of the mission architecture developed by the Franciscan Fathers in California (Fig. 11). Thus when the last adobe wall has crumbled we still have a replica of the Campanile of San Gabriel (Fig. 12) and the imposing arches of San Fernando, these



Fig. 9. Power House, Witherbee Sherman, Port Henry, N. Y.

having been duplicated in the Glenwood Inn at Riverside, California. Little other material than concrete has been employed—except the roof tile, which undoubtedly lend color to the scheme and interest to the picture. On the roof is a famous collection of bells, over 300, dating back to 1278. It seems, consequently, particularly fitting that these old relics, after their furious experiences, may now rest content, enclosed and surrounded by a structural material which will preserve their last resting place intact through the centuries to come.

Of a mission type, also, are the rest or way stations



Fig. 11. Courtyard, Glenwood Inn, Riverside, Calif.

of the Pacific Electric Railway, at Pasadena, California. These are fast replacing the old wooden rough and ready stations, none of which was consistent with the high class residential district through which the company operated. On both sides a bench is built into the wall so as always to furnish protection from rain.

An unexpected test of building materials presented itself during the San Francisco earthquake, and the architect for the delightful bell tower on the Mills College campus, Miss Julia Morgan, states that it was one of the few buildings which remained undamaged in that vicinity (Fig. 13).

Because it includes some of the most notable sculpture on the coast, the building of the Throop Polytechnic Institute at Los Angeles, Cal., may have interest (Fig. 14). It is all of reinforced concrete, even to the tower, and was designed by Myron Hunt of



Fig. 14. Throop Polytechnic Institute, Los Angeles, Calif.



Fig. 12. Glenwood Inn, Looking From the Street Into the Courtyard.

Los Angeles. The sculpture was executed in New York and cast in glue molds by a local company, the cost of this one item being something over \$5,000. Warm climates seem particularly suited to plain concrete construction, and its general adoption may partially be explained by the cool appearance of the plain surface.

Concrete, still in its formative state of development, is a comparatively new architectural material, although structurally it has been proving its permanence for many years. The particular reason for gratification comes in the new discoveries and new uses to which it is continually being put.

(To be continued, August issue.)



Fig. 10. Gary Water Tower, Gary, Ind.

CONCRETE CHIMNEY WITHSTOOD SEVERE WIND STORM

By Roy F Wilcox

Our attention has been called to your mention of the fact that our concrete chimney withstood the recent cyclone which swept this section, March 23, 1913. It may be of interest to you to know that this storm swept everything in its path, that it did great damage to our plant, which, in fact, was right in the center of the storm. Our buildings were practically destroyed. One of the large brick buildings, near our chimney, was crumpled into a pile, but the chimney is as straight and in as perfect condition as when first



Fig. 15. Pouring Concrete Floor With Panel Inserts of Molded Sand or Plaster.

erected. It stood the storm better than any structure on the place and as far as we can determine was not damaged in the least. This chimney was erected for us by the Weber Chimney Company, Chicago, and is conform in type. It is 147 feet 9 inches in height, with an inside diameter at the top of 6 feet.

"The shaft of the Wilcox chimney," writes Mr. Richard A. Steen, president The Weber Chimney Company, "tapers so that at the base of the shaft it has an inside diameter of 9 feet. The shell of the



Fig. 16. Sample of Paneled Ceiling Work Done With Sand or Plaster Molds.

chimney also tapers, being 4 inches thick at the top, increasing in thickness in a uniform ratio so that at the base it is 10 inches in thickness. A concrete lining 4 inches thick is provided, which lining is 45 feet in height from the top of the foundation.

"There is a circular air space between this concrete lining and the outer shell of the chimney 4 inches in width. The foundation of the chimney is 18 feet square, the sides of the foundation rising vertically to a height of 2 feet and from that point being sloped

into the shaft of the chimney, the height of the sloping part being 1 foot 9 inches. The reinforcement of this foundation consists of four layers of $\frac{1}{2}$ -inch square twisted bars, the two lower layers running diagonally to the sides of the foundation and forming lower network, which is 4 inches and 8 inches, respectively, from the bottom of the foundation. Above this there are two layers placed about 4 inches above the diagonal layers, which run parallel to the sides of the foundation and form the upper network.

"The reinforcement of the shaft of the chimney consists of $\frac{1}{2}$ -inch square twisted bars for vertical reinforcement, which bars run down into the foundation and are hooked into the horizontal network heretofore mentioned. The horizontal rings are also placed in the shaft at 14-inch centers. In the lining of the chimney there is a vertical reinforcement of $\frac{1}{2}$ -inch square twisted bars and horizontal rings are also placed 14-inch centers in the lining, in each case the rings being $\frac{1}{2}$ -inch round bars.

"A smoke opening 4 feet wide and 12 feet high is provided and the outer shell is thickened at the opening and additional reinforcement is placed around the opening.

"The concrete in the foundation is composed of a wet mixture of 1 part of cement, 3 parts of sand and 5 parts of gravel running from 2 inches down. The reinforcement in the shaft and inner shell is composed of a wet mixture of concrete of 1 part of cement, $2\frac{1}{2}$ parts of sand and 4 parts of gravel running from 1 inch down.

"The maximum bearing due to weight and wind on this chimney is 4,080 lbs. per square foot. The soil not being of very good bearing quality, it was decided to drive piles, and thirty-six piles, having a bearing value of 18 tons each, were driven and capped with 6 inches of concrete before the foundation was poured."

It is estimated that a velocity of 125 miles an hour was reached by the wind during the cyclone and the chimney was the only part of the plant not destroyed or injured.

TELEGRAPH POLES OF CONCRETE

Pennsylvania Railroad's Test Showed Their Superiority Over Wood.

The Pennsylvania Railroad is using, as an experiment, some re-enforced concrete telegraph poles which show a satisfactory degree of resisting power during such conditions as prevailed during the blizzards of last February. The new poles stood the test, while wood poles snapped like pipe stems.

It costs approximately \$125 to make and set up with proper foundation a single re-enforced concrete pole. But that it does not cost a great deal less than that amount to buy and install a wood pole equally strong is a statement that will surprise many persons.

Timber suitable for telegraph poles of first magnitude and suitable strength is growing harder to find, although reforestation now under way will perhaps expand the supply considerably within the next fifty years. Concrete is a commodity available in inexhaustible quantity. It is not cheap, although readers of popular articles recommending it as a substitute for wood often represent it as being cheap.

Concrete will be used in increasing quantity, but not to such an extent that the price of timber will be lowered by its competition. Concrete is not, by any means, the answer to the question, "What shall we do for building material if the forests are not conserved?"

Advantages of Hydrated Lime

The use of hydrated lime is a growing one with contractors and builders, but many do not appreciate how useful an article it really is, and what numerous advantages it possesses over lump lime.

Hydrated lime can be used for every purpose for which quick lime is used, and also for all purposes for which lime putty is used. It has also some uses which neither have. It, however, does not trowel quite so easily as lime putty, and this has been the greatest objection on the part of the mason to its use. By employing a good deal of water in the mortar, however, this objection can be to a great extent removed. The greater convenience with which it can be handled and used, however, and the thoroughness with which it has been slaked, to a large extent make up for this trouble. No mortar box is required and the hydrated lime and sand may be mixed upon a board, just as are cement and sand. It is, therefore, especially convenient for doing small jobs, such as repairs to plaster, etc.

It is estimated that it costs 25 cents per barrel to slake lime in a mortar box. This expense is saved by the use of hydrated lime. Furthermore, the mixing can be done indoors and in cities the streets are not blocked.

In using hydrated lime the mason should remember that not quite as much water would be required as is the case with lump lime, because in the case of quick lime some water is needed to combine with the lime, and in case of hydrated lime this water has already been supplied by the manufacturer. Where a mortar box is used, says the Improvement Bulletin, it is usually considered best to first place the water in the box and then the lime. More water and then lime can be added as necessary, the idea being to get a thorough mix of water and lime. It is usually considered better to allow the mixture to remain over night. Such a mortar can be used just as lime putty, and if plenty of water has been employed, will trowel very similarly.

One place where hydrated lime can be used, where ordinary lime putty cannot be employed, is with Portland cement. The addition of lime to Portland cement is not an adulteration, but confers a great many good properties to the latter. It has long been known that slaked lime would waterproof concrete. This is due to the fact that it exists in the form of an extremely fine powder, many times finer than the finest ground cement. This fine powder fills in the pores of the concrete and stops them up, thus excluding the water. Owing to the difficulty of mixing the wet lime putty with the dry cement and sand, however, it has only been since the introduction of dry hydrated lime that slaked lime could be used for waterproofing. It is generally considered that hydrated lime is the best waterproofing compound which can be added to cement, and that it is superior in lasting qualities to any of the waterproofing compounds at the present time advertised for this purpose. The writer has tested some eight or ten of these compounds. In every instance, without exception, they decreased slightly the strength of the cement mortar made therefrom, and he does not think that any of the manufacturers claim that they add to the strength of concrete. Hydrated lime, on the other hand, not only waterproofs the concrete, but numerous tests made in different laboratories by disin-

terested parties show that additions of hydrated lime up to 15 or 20 per cent increase the strength of cement mortar.

As an actual waterproofer, hydrated lime is not surpassed by any of the waxes and paraffin compounds at the present time used for this purpose. Many of these compounds are organic, and in time will volatilize, leaving the concrete porous. Hydrated lime, on the other hand, is inorganic or mineral, and will remain where it is put.

As an example of the waterproofing properties of hydrated lime, this was employed upon a large gas holder at Kingston, Ont., which had been practically a failure, owing to the leakage of the concrete wall of the gas holder. A number of waterproofing methods were tried, all of which failed, and it was not until this wall was chipped back from three to six inches by means of pneumatic chisels and a new wall composed of concrete, containing about 18 per cent of the weight of the cement of hydrated lime had been added, that the tank was waterproof.

The addition of hydrated lime to cement makes the latter more plastic and easily troweled. It also improves the adhesive properties. A mixture of equal parts of hydrated lime and Portland cement makes an ideal mortar for laying brick. The addition of hydrated lime to concrete blocks makes the latter whiter, tougher and waterproof.

Hydrated lime is not only the best but also the cheapest waterproofing compound known, since it replaces so much cement and the only additional cost is the difference between the price of cement and hydrated lime, which is slight, even at the present low price of cement.

For household, agricultural and industrial purposes, where only a small quantity of lime is used, and where storage in the cellar or a shed upon the premises is desirable, hydrated lime is unsurpassed, owing to the fact that it can be easily mixed and handled, keeps indefinitely, is put up in small paper packages (40 pounds), and finally that there is no danger of fire from it. Lime has long been used as a disinfectant, for whitewashing, for fertilizing, for spraying fruit trees, for purifying of water, or marking lawn tennis courts, and for all of these uses hydrated lime possesses every property of quick lime. For such uses as water purification, disinfecting, fruit spraying, etc., magnesian hydrated lime has only about one-half the value of the high calcium hydrate.

Hydrated lime is usually packed in 40-pound paper bags or 100-pound cloth bags. The paper bags are of the valve type, and are pasted shut at both ends, presenting a square package, which can be easily handled and, owing to the absence of the rough tied end found in cement bags, can be closely packed. Below are some standard formulas for the use of hydrated lime:

First cover bottom of mortar box with water and add the hydrated lime and more water as is necessary. Some mechanics prefer to soak the hydrated lime at least twelve hours before using, claiming more plasticity in its manner of working.

For Plaster Mortar—First or Scratch Coat: 350 pounds hydrated lime, $\frac{1}{4}$ yard screen sand, 2 bushels hair. Should cover about 100 square yards.

Second Coat: 200 pounds hydrated lime, $\frac{1}{2}$ yard screen sand. Should cover about 100 square yards.

Putty or White Coat: Use about one-half as much plaster to gauge with as is commonly used with putty made from lump lime. If wall is dry sprinkle or dampen with brush before putting on white coat, as labor will be lessened.

Float Finish: 300 pounds hydrated lime, $\frac{1}{4}$ yard screen sand. Should cover about 100 square yards.

For Stone Mortar: 200 pounds hydrated lime, $\frac{5}{8}$ yard screen sand and add water.

For Brick Mortar: 250 pounds hydrated lime, $\frac{5}{8}$ yard screen sand.

Hydrated Lime and Portland Cement Mixture for Laying Brick and Stone—For hard mortar for these purposes use equal parts by weight of hydrated lime and Portland cement. Add required amount of sand to properly gauge up mortar.

For Waterproofing Concrete and Concrete Blocks—Replace 15 to 20 per cent of the weight of the cement used in the mortar by hydrated lime.

To Sum up the Advantages to the Dealer—It is first of all a fixed product which does not deteriorate or change with age, nor swell and burst its packages, consequently it is always worth the market price of lime. Second, it can be handled without risk of fire, and, third, it cannot only be used for all purposes for which lime is used, but also has many new uses and is more convenient of application.

It has been aptly said that hydrated lime is the twentieth century way of handling the lime trade.

CONCRETE SEWER PIPE VINDICATED

Great Victory Over Competitive Materials Won by Concrete Sewer Pipe in Kansas City, Mo.

Illusions are hard to dispel, but must give way to facts of experience. If anyone doubts the efficiency of concrete pipe, when properly made and laid, for sewerage purposes, the experience of Kansas City, Mo., in using this type of conduit will probably be sufficient to clear his mind on this question.

Full details are presented in a paper read before the annual meeting of the Illinois Society of Engineers and Surveyors at Peoria, Ill., January 28-30, by E. S. Wallace, cement inspector, of Kansas City. The city uses reinforced concrete sewer pipe 30 to 33 in. in diameter, and plain concrete pipe 10 to 24 in., the reinforced pipe costing \$1.50 to \$1.90 per ft., and the plain 17 cents to \$1.06. Plain concrete pipe up to 12-in. diameter is of cement and sand 1:2 $\frac{1}{2}$. Larger pipe may be of the same mixture, or of 1 cement, 1 sand, and 2 stone. The thickness is from $\frac{3}{4}$ in. for 6-in. pipe, to 2 in. for 24-in. pipe. The crushing strength is from 1,000 lbs. per lin. ft. for the smaller, to 2,000 lbs. for the larger size; and in the hydrostatic test the untreated pipe must show no percolation up to 10 lbs. per sq. in., and shall resist fracture at 33 lbs. per sq. in. internal pressure. Mr. Wallace's conclusions are as follows:

Our tests have shown conclusively that there are three things essential to the manufacture of good concrete pipe: 1. The pipe must be composed of proper materials; 2, it must be made right; and 3, it must be cured right. Too much emphasis cannot be placed on the fact that curing is as essential as the materials from which the pipe is made, or the method of manufacturing, for it is possible for a manufacturer to exercise all the care possible in the first two matters and ruin the output of his plant by improper curing.

After the molds have been removed, the finished pipe should be kept thoroughly moist at a temperature of about 70° F. for at least 10 days; and in extremely hot or cold weather, it should not be exposed to the elements for a much longer period.

During the winter of 1912-13, considerable difficulty was experienced on account of improper curing. The storage sheds were heated with stoves, and pipe placed too near them dried too rapidly, while those near the sides of the shed were retarded in setting on account of the cold. It was expected that when warmer weather arrived this difficulty would be overcome; and this was the case to some extent until the extreme dry hot weather came. Then, as the storage capacity was inadequate, large numbers of pipes were placed in the yard, exposed to the air and sunshine, before they were properly cured. This was found to be as great (if not greater) detriment than the cold weather.

The writer has made experimental tests on a number of 8-in., 10-in., and 12-in. pipes of ten days' age, that were properly cured up to that time, which have resisted from 60 to 90 lbs. internal pressure without showing any signs of seepage or percolation. Pipes of the same size and made under the same conditions, and of much greater age, but which had been stored in the open and exposed to the elements, have repeatedly failed below the specification requirements. The manufacturers of these pipes use no waterproofing; and hundreds of tests have demonstrated that none is required where materials are carefully selected and proper care is exercised in manufacturing and curing.

During the year we have made 530 tests on concrete pipe ranging in size from 8-in. to 24-in., 411 (or 77.55 per cent) of which passed both percolation and pressure tests. This does not represent the percentage of loss of the output of the plant, as most of the failures occurred during July, August, and September, when the weather was extremely dry and hot. Under weather conditions such as existed in the spring and late fall, this loss would probably be reduced about 50 per cent. Of the 411 pipe which passed, 99 resisted pressures ranging from 34 to 106 lbs. We have practically abandoned the compression tests, as we have never found a pipe of either clay or concrete that failed below specification requirements.

There is but little difficulty experienced in handling concrete pipes, as they are not brittle and resist considerable impact before fracturing.

The pipes are made on a machine having four revolving tamping bars, eccentrically worked and striking 300-lb. blows at 150 blows per minute. The core works on a revolving screw, and remains stationary during the tamping; then it is started, and, after making a sufficient number of turns to trowel the interior, it drops below the floor. This troweling of the interior is important; and when the pipe is properly made, it has the smooth, glazed finish desirable for sewer work. The concrete is a dry mix, fed from an overhead bin through a 3-in. pipe and deposited directly in front of the tampers.

The finished pipe is taken to the curing shed, where it is placed on end and the mold is removed. It is strong enough to stand without allowing additional time for the cement to set. It is kept moist for about ten days before being removed to the storage yard. The concrete is of a consistency that will barely hold together when pressed firmly in the hand; and after the molds are removed, the "water web marks" show plainly over the exterior. Our tests have demonstrated that when the mix is so dry that these marks do not show, the pipes show seepage or percolation on test and usually fail at a low pressure.

In 1912, Kansas City laid over 35,000 lin. ft. of plain concrete pipe, and in 1913 over 75,000 lin. ft. in sizes ranging from 8 in. to 24 in. There have been no failures. The pipes were manufactured by the Kansas City Concrete Pipe Co.

Stone Crushing and Screening Plant, Fairmount, Ill.

The quarry of the Casparis Stone Co., at Fairmount, Ill., has always been operated exclusively for furnishing limestone to the United States Steel Corporation, to be used as flux in the furnaces of the Illinois Steel Co. and the Indiana Steel Co. at South Chicago, Ill., Joliet, Ill., and Gary, Ind.; and also for mixing with slag at the mills of the Universal Portland Cement Co., at Buffington, Ind. The material consists of a high-grade calcite.

Quarry Work and Plant

The deposit of calcite has an average thickness of only 20 ft., and it is covered with about 12 ft. of earth. Stripping is done with steam shovels. The unusual depth of the overburden as compared with the thickness of deposit makes it especially important to reduce cost at this point, and everything possible has been done to that end. The shovels used are of the Marion type, manufactured by the Marion Steam

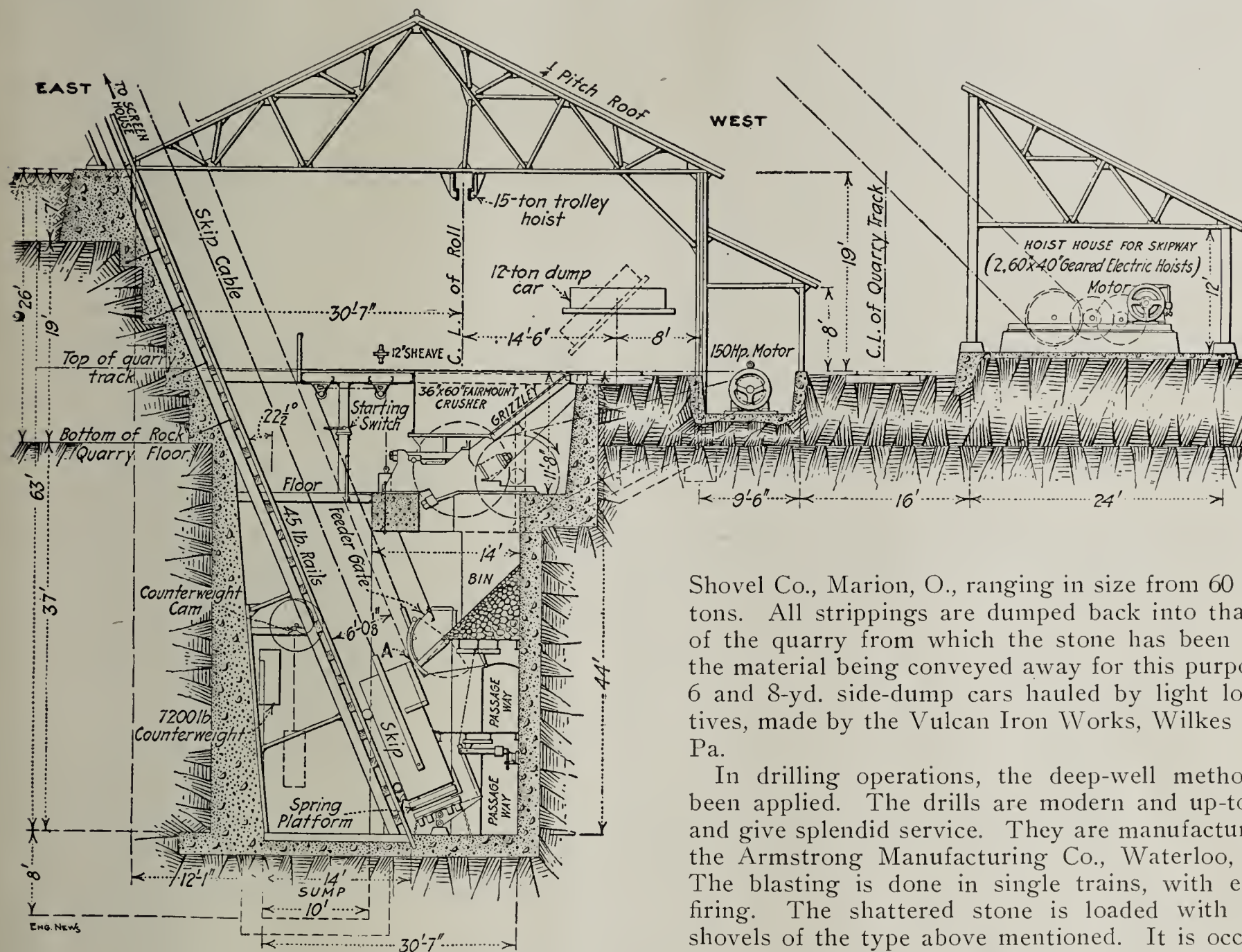


Fig. 1. Cross-Section Through Crusher House; Showing Roll Crushers, Skipway to Screen House, and Hoisting Plant for Operating the Skipway Cables.

Operations started in 1898. At that time the crushing plant was equipped with a No. 6 Gates breaker, which was soon after replaced by a No. 7½. The latter continued in service until 1904, when a new plant, including a No. 9 Gates breaker, was installed. This has been operated continuously both day and night, until the present year. The No. 9 plant is equipped with hoists, continuous bucket elevator, screens, etc., such as are commonly installed for similar purposes. The present plant, described in this article, is installed with a view to securing the best possible operating efficiency not only in the crushing operations themselves, but also in enabling larger blocks to be handled in the quarry and the quarrying costs thereby reduced. This plant was put in operation during 1912.

Shovel Co., Marion, O., ranging in size from 60 to 100 tons. All strippings are dumped back into that part of the quarry from which the stone has been taken, the material being conveyed away for this purpose by 6 and 8-yd. side-dump cars hauled by light locomotives, made by the Vulcan Iron Works, Wilkes Barre, Pa.

In drilling operations, the deep-well method has been applied. The drills are modern and up-to-date, and give splendid service. They are manufactured by the Armstrong Manufacturing Co., Waterloo, Iowa. The blasting is done in single trains, with electric firing. The shattered stone is loaded with steam shovels of the type above mentioned. It is occasionally necessary to reduce large pieces of rock by "dobeying." During cold weather it is found difficult by ordinary means to prevent the dynamite from freezing, and W. O. Taylor, vice-president and general manager of the Casparis Stone Co., conceived the idea of making a dynamite carrier on the principle of the "thermos" bottle. With each of these he succeeded in keeping the dynamite 24 hours without freezing, even when the weather got to 20 degrees below zero. The use of the new carrier proved, in fact, so successful that a separate company has been formed to take over its manufacture and sale.

The stone is loaded in 8-yd. (12-ton) side-dump cars, eight of which are coupled in a train and hauled distances varying from 500 to 5,000 feet to the new crushing plant by 35-ton Vulcan locomotives. The haul is approximately on level track. At the crushing plant the arrangements have been so made that cars can come in from either direction or can be run through the plant.

New Crushing Plant

The new plant consists mainly of a crusher house and a screen and bin house, with an inclined skipway from the pit below the crushers to the bin above the screens. At present there are two units, but the foundations have been placed for a third set of crushers and the necessary extension of the buildings. The units are spaced 16 ft. 3 in. c. to c., this being the overall length of a car. This enables two cars to be dumped simultaneously at present, and three can be handled at the same time when the third unit is ready for service.

The illustration herewith is a section through the crusher house. The rock dumped from the side-dump quarry cars passes to each crusher through a chute with a bottom formed of a grizzly or screen 3 and $2\frac{1}{2}$ in. x 10 in. x 8 ft. It is fed to the hoppers of two 36x60 in. roll-crushers of the Fairmount type by which it is reduced to 8 in. and smaller, falling from each crusher to a rectangular bin which has a capacity of 16 tons. Each crusher is driven by belting from an electric motor of 150 h. p.

In each of the crushers the rock is reduced by a continuous feeding and crushing action from sledging blows delivered by the projections on the roll against the rock, which is held against the anvil block. These successive continuous crushing blows produce a gripping action upon the smaller pieces of rock in the charge delivery to the crusher, crushing them by pressure with a clean sharp break. Each piece drops lower on the anvil block, following each blow, until it leaves the machine. After the smaller pieces in the charge of rock delivered to the crusher have been crushed and passed through the machine, the large pieces (which are automatically rejected until the last) are first sledged and turned over to present new surfaces for crushing until they are broken into sizes small enough for the gripping, crushing action mentioned.

The operation of crushing has the effect of clearing the crusher from fine material before the large pieces add their quota of crushed material to the product. This avoids choking and effects a uniform feed of crushed material delivered by the machine. The action also has a further advantage. Thus, should any pieces be sent to the machine too large to be crushed, the tendency of the operation of the machine is to clear the hopper of the remaining rock in the charge delivered to the crusher so as to make it a simple and easy matter to remove or turn over the very large pieces of rock. In this way it is not necessary to dig out the entire charge, as may be the case with jaw and gyratory crushers.

Handling the Crushed Stone

The capacity of these crushers and the large amount of stone to be handled opened an entirely new problem in the stone-crushing industry. The Casparis Company being unwilling to adopt in a plant of this magnitude the old methods of handling stone, suggested the use of skips. The problem of thus handling stone in a practical and economical manner was solved by the Allis-Chalmers Company's engineers in an original manner. Each pit or bin into which the crushed rock is discharged opens towards a skipway inclined away from the crushers at an angle of $22\frac{1}{2}^\circ$ from the vertical. The stone from each crusher is elevated by two skips operated by cable and working in balance, except for the weight of the material being hoisted.

Each skip in its descent to the loading position engages a latch A on the bin gate, causing it to open downward. The gate, however, is so proportioned that no stone is discharged into the skip until the lat-

ter has reached its proper loading position. The bin gate is held open by the weight of the skip until there has been discharged into it from the bin its normal load of eight tons of crushed stone.

During the time that the skip receives its load it rests against a spring-supported platform at the bottom of the skipway. This platform serves a double purpose: 1, it absorbs the shock of the descending skip, and 2, when the skip is started the springs exert an upward pressure upon it momentarily, thus greatly assisting in the starting of the hoist motor. The plant is so designed that the latch holding the bin gate can be automatically tripped by raising the counterweight attached to the spring platform, or it may be manually released by an operator pulling on a rope.

As the descending skip approaches the bottom of its travel, the loaded skip approaches the top of its travel, and both skips are stopped simultaneously. The stopping of the hoist which operates the two skips is effected by means of a standard traveling-limit switch, connected to the drum shaft of the hoist. This is so designed that near the end of the travel the proper amount of resistance is exerted to slow down the motor, and, at a predetermined position, the solenoid operated main line switches are opened by breaking the circuit through the traveling-limit switch.

This switch has as its principal movable element a nut traveling in guides, this nut being directed in its travel by the rotation of a screw. The screw rotates in opposite directions with the reversals of the hoist, causing the nut to travel in opposite directions, thereby stopping the skips at each of the predetermined limits of travel. When the skip at the bottom of the incline has received its proper load of stone from the bin, the latch holding the bin gate open is tipped, allowing the gate to be closed by its counterweight. During the last movement of the bin gate, just before closing, a clip on the cable of the counterweight engages with an electric switch which starts the hoist. After the skip has reached the limit of its travel, the hoist is stopped by the traveling-limit switch, and the above operation is repeated for the alternate skip as soon as it has been filled with stone.

There is one hoist and a pair of skips for each crusher. Each hoist is driven by a 125-hp. three-phase, 60-cycle, 550-volt induction motor, which is geared to the hoist and fitted with solenoid brakes. The motor runs at 560 r.p.m., and the hoist has a rope speed of 200 ft. per min., equivalent to about 13 r.p.m. for the drum shaft. The lower and upper ends of the skipway are shown in the illustration herewith. It will be seen that each skipway has two sets of rails forming separate gantletted tracks with centers $4\frac{1}{2}$ in. apart, the track gage being 5 ft. 7 in. In approaching the top of the incline the tracks swing apart by curves of 110 ft. radius and are then parallel, with centers 7 ft. apart. At the head of the incline the track rails become horizontal, and on these run the front wheels of the skip. The rear wheels have double treads, and at this point the outer (smaller) treads engage with inclined dump-rails, up which they ride; in this way the skip is tilted and discharges its contents into the bin.

When the special electric switch above the bin gate is actuated by the closing of the gate, a secondary circuit is closed which energizes the solenoid of the main line reversing switches to the hoist when these switches close, current is admitted to the motor and at the same time the solenoid attached to the brake is energized, thereby releasing the brake. The hoist motor is of the wound-motor type, with slip rings and variable resistance. The closing of the contactors which automatically cut out resistance is

at first prevented by the heavy rush of current action on a series relay. As the motor accelerates and the current value decreases, each step of resistance is automatically cut out, there being five steps in all. As the nut on the limit switch, referred to above, approaches one end of its travel it first opens a secondary contact which causes all the resistance switches to open, thereby throwing full resistance into the circuit of the rotor of the hoist motor.

In actual practice this switch opens when the switch is about 10 ft. below its dumping position. Due to the resistance inserted in the rotor circuit, the hoist slows down and is stopped at a predetermined position by the opening of a second switch (finger contact). One switch for cutting in resistance and one switch for stopping the hoist are provided at each end of the travel of the nut above mentioned. The control switches at both ends are closed except when the nut is in its final position at one end or the other. Current, however, can only be admitted to one side of the main-line reversing switches through the special control reversing switch which is operated by the closing of the bin gate.

The material from 1½ in. to 5 in. is used for flux in the blast furnaces. The oversize stone is used in open-hearth furnaces, and a part of it is sent to the cement plant, where it is crushed in No. 6 Gates crushers. At certain seasons of the year the dust must be screened from the 1½-in. size in order to prevent the material from freezing in the cars.

From the trommels or screens the stone falls directly into bins for the different sizes. These bins

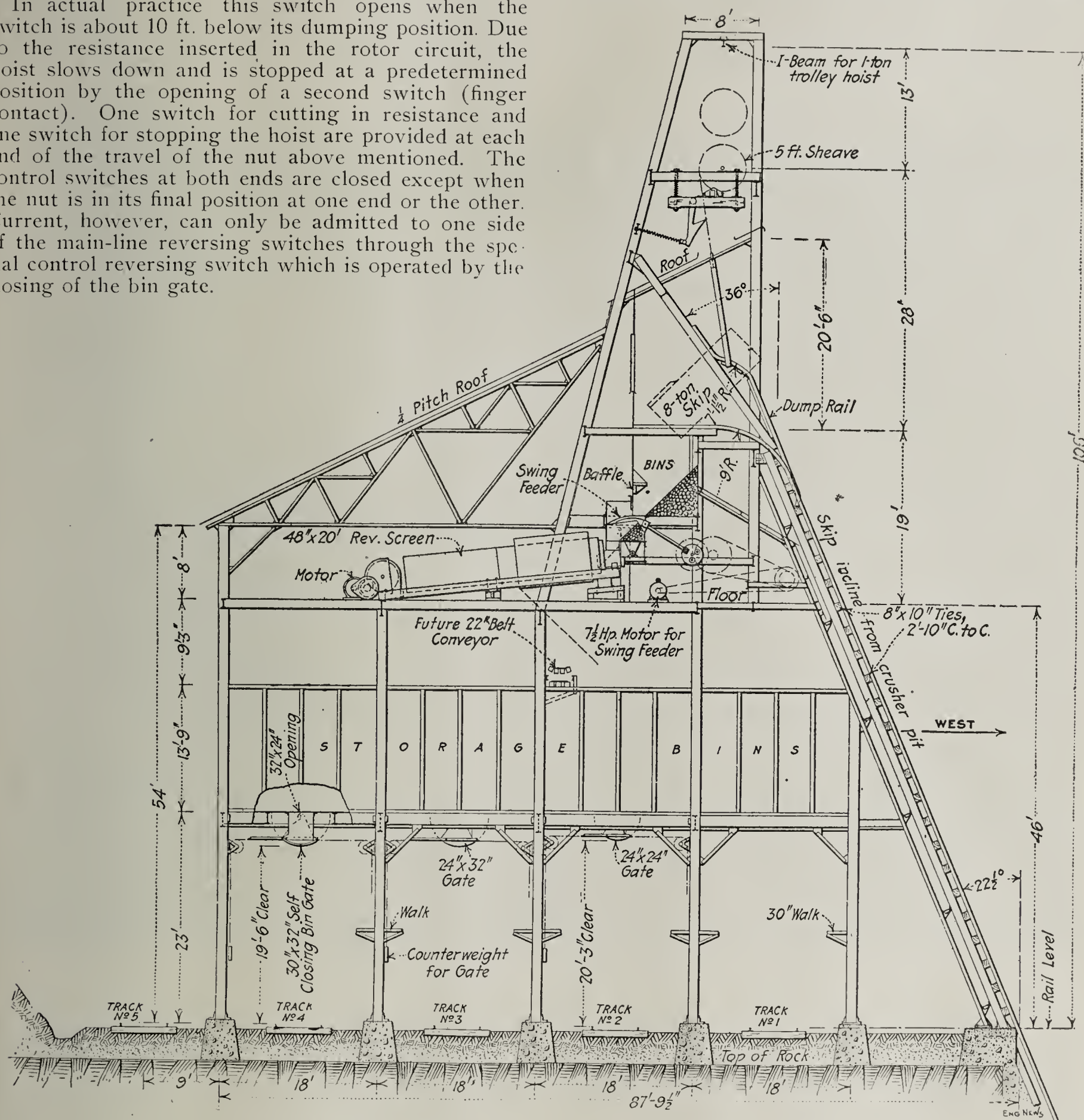


Fig. 2. Cross-Section Through Screen House; Showing Skipway, Screens and Storage Bins.

Screens and Storage Bins

At the top of the skipway the crushed stone is discharged to bins with an aggregate capacity of 120 tons, as shown in the cut herewith. From these it is fed through Gates automatic swing feeders to four 4x20-ft. revolving screens, inclined 1½ in. per foot. Each screen with its charge of stone weighs about 15 tons. These screens separate the material into 1½ in. to 5 in., and oversize (which last is 8 in.). The 1½-in. and finer stone goes to the portland cement mills.

are of the box type, the stone forming its own hopper. The bin gates are of the radial opening pattern, made exceptionally large and heavy on account of the size of product to be discharged. Railway cars are run underneath the bins on four tracks, a fifth track being provided as a run-around for bringing in empty cars. The total weight of stone when all the bins are level full is about 1,200 tons, taking the weight of the stone at 100 lb. per cu. ft.

The power plant consists of four Heine water-tube

boilers and one 600-kw. Parsons turbine-alternator, with steam and motor-driven exciters, manufactured by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The plant was designed and machinery furnished by the Allis-Chalmers Co., of Milwaukee, Wis., and the structural steel work was designed and furnished by the North Works (Chicago) of the Illinois Steel Co. The plant was erected and started under the supervision of K. E. Casparis, assistant general manager, Casparis Stone Co., Columbus, O.

BIG BLAST AT RIVERSIDE

Out at the plant of the Riverside Portland Cement Company, Riverside, Cal., at 12:20 o'clock today (June 5) 400,000 tons of solid rock was lifted bodily into the air and then crumbled down into millions of fragments. This was the result of the heaviest charge of dynamite ever set off in the state of California and true to the forethought and care of the experts in charge, the mountain cracked and fell away, almost to the foot, from the point, far up on its side, where it was estimated that it would.

The work leading to this immense blast was started four months ago and all of it has been under the direct supervision of dynamite and blasting experts, a plan that it is now being followed by the cement company in all of its big blasts.

The nearby country, within a radius of a half mile or more, was well dotted with human ants, who gathered to witness a sight that is not often given to man to see, and as they awaited the destruction of the mountain of rock representatives of the cement company explained to them the manner in which the preparations had been made and described to a nicety just what would happen when the electric button should be pressed that would bring on the change in the landscape.

For four months the work of drilling and digging two big tunnels back under the portions of the mountain to be attacked has been progressing. One of these was under what is known as the Lone Star quarry, at the northeastern part of the mountain. The other was under another quarry to the south of the first.

As a result of the work of these two big shots there has been loosened a sufficient amount of lime rock to keep the company busy for more than a year in removing it, clear from the two quarry bed levels.

The company officials and experts reported the results of the day's work as perfect and not to be improved upon. Some little apprehension had been felt as to one of the jobs because of the fact that a few months ago an attempt was made to fire a blast similar to one of those of today and but two of the charges in the tunnels had gone off. The remaining number were fired today successfully, however.

The explosions and the resulting displays of heaving rock and dust were witnessed by most of the Riverside city officials, officials of the company, newspaper men and many spectators.

DU PONT POWDER PUBLICATIONS

Information on blasting powders, dynamite and methods of handling high explosives is given in the following publications issued by the E. I. du Pont de Nemours Powder Co., Wilmington, Del. The June edition of the du Pont Magazine contains such subjects as the importance of correct methods in priming dynamite, method of lighting fuse, means of removing boulders and a schedule of Du Pont products. Catalogue "A-167," Du Pont Blasting Powder, gives

a history of the founding of the Du Pont Powder Co. and its interesting development. Descriptions and properties of blasting powder; handling, transportation and storage; priming, charging and tamping and other methods are illustrated with sketches; and use of blasting powder in coal mining, quarry, railroad and earth and clay excavating, etc., are given in detail. A "Farmers' Handbook" and "Agricultural Blasting" are the titles of two other catalogues issued by the company. The "Farmers' Handbook" contains illustrations in the use of dynamite for clearing land, planting and cultivating trees, drainage, dredging and subsoiling; and "Agricultural Blasting" contains general information for blasters and agricultural blasting as a business. These publications will be sent to interested persons on request to the company.

LENNI QUARRY COMPANY

The crushing plant of the Lenni Quarry Company at Lenni, Pa., has been enlarged during the past winter months for the purpose of increasing the output of crushed Lenni Trap Rock. They have installed a 60x84-inch jaw crusher (one of the largest in the United States) and two 22x50-inch jaw crushers; two steam shovels, two locomotives, two well drills, a locomotive crane, two new Nagle-Corliss engines, new elevators, new screens, and other machinery for the production of crushed stone in all the specified sizes for road building and concrete work. Lenni Trap Rock is a good local stone, of which there is a large deposit at Lenni, and according to analysis made by the United States Department of Agriculture, Office of Public Roads, Washington, D. C., it is one of the best stone products for resurfacing roads, as it has good wearing qualities. The location of the crushing plant of the Lenni Quarry Company will enable the townships and boroughs in Delaware county and vicinity to use a good local stone to put their roads in repair at a saving, during the coming season, as the saving in freight haul, etc., will be considerably less than from quarries in Pennsylvania which are located many miles away from this territory.

COMPILES SAND AND GRAVEL DATA

The Security Cement & Lime Co., Hagerstown, Md., has compiled data under the title, "The Selection of Sand for Concrete," which will be of great interest to those who find difficulty in determining the qualities of different sands. The pamphlet is an abstract of current technical literature published in the interest of cement users. Especial emphasis is laid on the proper proportioning of the sand aggregate in all manner of concrete construction.

The booklet is known as "Concrete Pointers No. 1," and additional data on the properties of aggregates for concrete are being collected and will appear in a future number of "Concrete Pointers," issued by the Security company. Such subjects as sharpness, loam or clay, vegetable or organic impurities, mica, coal dust, coarseness of sand, percentage of voids, taking sample at bank, taking sample from piles at bank, taking sample on the job, general cautions, etc., are treated in brief in the booklet.

IDAHO CEMENT LAND

The Commercial Club of Pocatello, Idaho, writes as follows: "We have here one of the best opportunities from every standpoint for a large cement plant and are willing to furnish parties interested any data they desire."

Protecting Structural Steel with Gun-Crete

The question of maintenance of structural steel, subjected to the action of the elements and other corroding agents of a more severe nature, has long confronted the engineer as one of the most uncertain and costly elements entering into the design of steel structures. All structures of steel unless properly protected require constant care and attention in order to prevent their decomposition through development of rust and corrosion. In many cases the ordinary methods of painting are utterly insufficient, and where con-

ditions are unusually severe, or where the work is of such a character that thorough inspection is practically impossible, the decomposition of such structures when left unprotected is so rapid that the loss of sections by corrosion may cause serious weakness in a comparatively short time.

materials, they have turned to concrete as the only satisfactory solution of this problem. In covering steel with concrete for the purpose of protection, some means of securing as thin a protective layer as possible must be chosen, in order to reduce the additional weight which must be carried. It is therefore necessary that this layer be reinforced in order to prevent cracking. This is especially important in the case of bridges, viaducts and other structures subject to constant jar and vibration. Such



Interior Grand Central Terminal, New York City. Structural Steel Work Protected by Cement.

The problem of protecting over 2,000,000 square feet of structural steel surface in the substructure of the new Grand Central Terminal in New York City was by no means the least of the many encountered in that great structure.

Modern practice has shown a tendency among engineers to get away from the practice of erecting unprotected steel work in places where the structure is subjected to severe corroding agents or where the nature of the work prevents ready access to all exposed parts. After experimenting with many ma-

reinforcement must be of a kind which can readily be adjusted to thin layers of concrete and also be easily fitted to the varying steel shapes to be protected.

It was decided to protect all the exposed structural steel on the lower levels of the Grand Central Terminal, from Forty-second street to Fifty-seventh street, north and south, and from Madison avenue to Lexington avenue, east and west, by encasing it in concrete. This steel surface area, estimated at about 2,000,000 square feet, includes all classes of structural steel, beams, girders, braces, columns, knees, buckle plates, etc.

The cement gun was chosen as the only practicable means of applying the concrete. The contract for the furnishing and placing of the reinforcement was given to the Clinton Fireproofing Company of New England.

The type of reinforcement used on this work was chosen only after considerable experimenting with various materials. It was decided to use Clinton electrically welded fabric, a 2-in. by 2-in. mesh of No. 12 gauge wires. The company had previously been using a $1\frac{3}{4}$ -in. mesh No. 12 gauge woven fabric. This material proved a failure on many kinds of work, the reason being that it was impossible to cut the fabric to conform in all cases to the shape of the structure without having the material become distorted in mesh, in a great many cases resulting in the collapse of large portions of the fabric. This, of course, was owing to the very nature of its manufacture. It was woven together and was not meant to be cut, as was found necessary on this work. No other reinforcements of a loosely constructed nature could be adapted. There

cross insures rigidity. The small pieces and trimmings remain intact and may be used and worked in on many places in the construction, with the result that there is no loss or waste of material.

The erection of the wiring on all plate girders consists of placing $\frac{3}{8}$ -in. round rods on both faces of the girders, held to them by means of No. 6 gauge wires inserted through $\frac{1}{2}$ -in. holes (bored by the railroad company), and securely drawn together. To these $\frac{3}{8}$ -inch rods is laced the Clinton fabric. This allows for a space of about $\frac{1}{2}$ in. back of the wires to permit the cement mortar from the cement gun to flow behind and form a perfect key. The wiring in all cases is erected to conform to the shape of the steel, no matter what structural member is being covered. This is done to keep down the dead weight, as it is entirely



Steel Columns and Girders in the Grand Central Terminal, New York City, Wrapped With Clinton Welded Wire. Then a Concrete Coating Was Applied With the Cement Gun.

was so great an amount of cutting and fitting to be done, in order to bring the fabric to the shape of the steel itself, that only by the use of a material of rigid construction could economy be assured.

The Clinton electrically welded fabric is made from a galvanized high grade cold drawn steel wire, having an ultimate tensile strength of about 65,000 pounds per square inch. The wires are all electrically welded together by machine and put up in rolls, in this case 300 feet long and 58 inches wide. The particular advantage of this fabric lies in the way in which it may be cut without going to pieces or being distorted. The welding together of the two wires at each place they

possible to follow the shape of the steel by means of the cement gun. This system gives a protective coat about two inches thick over all steel.

The massiveness of the work in portions of the station is illustrated very clearly in Figure 1. This also shows why a fabric which will not ravel or become distorted when cut is necessary. It has been cut to shape for the segmental arch construction as if it were a piece of cloth, but has remained intact. The use of small pieces to fill out the small places is also illustrated. Around the brackets the material has been bent tight to the steel, being held off simply by the rivets, allowing enough space for the mortar to form

its bond. The soffits of the beams on the sides of the segmental arches are covered with the same mesh. segmental arch forms, left in place the wires that held The railroad company, when removing their wooden these forms while the concrete was setting. These have been used to advantage by running two $\frac{3}{8}$ -in. rods along each side of the beam and holding them to the beam by wrapping these wires around them. To these rods is laced the reinforcing fabric. Figure 1 also shows how the fabric is brought around the stiffener angles of the plate girders at the right. The work shown is ready for the cement gun application. Figure 2 illustrates a portion of finished work in the terminal. The concrete on the large sway braces was poured in forms and is not cement gun work.

The vast number of cross beams is shown in Figure 2. These beams are built-up plate and angle beams, spaced about 24 inches apart, supporting part of the traffic of the upper level. The wire fabric is carried up the sides of the beams, across the top, which is formed by buckle plates, and down along the side of the adjoining beam. In other words, there is a continuous wrapping of fabric over every square inch of steel. The columns on the side have been completed by the cement gun and show the manner in which this work preserves and brings out the shape of the columns and brackets. This work has a protection of only about two inches, eliminating the bulky and weighty mass of concrete the members would have to support if the concrete were poured in forms.

GUN-CRETE WORK

The Gun-Crete Company has opened its new office in the McCormick Bldg., Chicago. The firm specializes in Cement Gun work for engineering, industrial and mining structures. It has at its disposal a large amount of the most modern cement gun equipment, and a very efficient working organization.

The Gun-Crete Company also introduces the Weber system of hollow concrete floor construction. These floors are being erected without forms and are very advantageous in every respect being sound, fire and waterproof, light and equally well adaptable for office buildings, warehouses, factories and residences. The firm will license contractors everywhere to build such floors.

Another specialty of the firm is the encasing of structural steel work for buildings, bridges, etc., for rust and fire protection.

Mr. Carl Weber, the president of the Gun-Crete Company is undoubtedly one of the best known concrete engineers in America. He is the inventor of the reinforced concrete chimney of which thousands have been built in this and foreign countries, and has designed and built a large number of other important engineering structures. He has been connected with cement gun operations for some time and is considered to be one of the leading experts in this line of work.

NEW LIME HYDRATING PLANT

O'Neal's Lime Works, Calera, Ala., is constructing a hydrating plant with a daily capacity of fifty tons of hydrated lime. A batch hydrator has been installed which has given good satisfaction on the company's high calcium lime, according to C. L. O'Neal, proprietor of the concern. Other machinery includes a Sturtevant rotary crusher, Jeffrey and other transmission machinery, Jeffrey vibrating screens, and Urschel-Bates valve bagging machinery, together with other equipment which it was found necessary to purchase. The plant is well under way and the machinery is being installed.

CEMENT DRAIN TILE IN MUCK GROUND

By C. W. Boynton

Referring to the letter published in the January issue of Cement & Engineering News on page 3 by William Passage of Bailey, Mich., reciting his failure in making a good strong cement drain tile on the small "Farmers" hand power machine which he has, will say the main cause of the failure of the tile mentioned in Mr. Passage's letter is evident in the mixture used—1 part cement to 5 parts of sand. Such a mixture is entirely too lean for the manufacture of first class drain tile and fine grained sand would make matters worse. Modern practice in cement tile manufacture requires the use of a mixture no leaner than 1 part cement to 3 parts of sand and the latter must be clean and well graded from fine to coarse particles just passing a $\frac{1}{4}$ -inch screen.

The statement is made that one 3-inch cement tile will drain as much ground as two 6-inch tile of clay. Tile made as porous as this implies could not be expected to have any real strength and durability. But tests and experience have thoroughly disproved the old idea regarding improved drainage due to porous tile—and up to date cement tile manufacturers realize that good cement tile must be impermeable.

A longer time than 6 days should be given to curing cement tile before placing in the ditch particularly if they are cured by "natural" methods. Modern practice recommends the following for "natural curing." During warm weather factory made pipe or tile should be stored in an enclosure where they will be protected from drafts and against drying out. After hardening sufficiently they should be sprinkled at least three times a day for a period of 6 days, after which they should be piled in the yard for at least 24 days, being sprinkled three times a day for the first 7 days. During freezing weather the tile must be stored in an inclosure where they will be protected from drying out and against frost and after hardening should be sprinkled at least three times a day for a period of at least 12 days, after which they should be piled in the yard for at least 18 days without receiving further treatment.

Curing tile in steam curing chambers is much better than natural curing, since it is more rapid and is not influenced by weather conditions or temperature changes, thus giving a product more uniform in quality and strength. Every manufacturer of cement drain tile who wishes to run his plant in the most efficient and economical manner should provide an equipment for steam curing.

In conclusion we wish to say that we know of no instances where properly made cement drain tile have been in any way injured by contact with ordinary muck soil.

Dr. W. E. Hilgarde, of the Agricultural Experiment Station of the University of California, says in regard to the possible action of soil acids on concrete, "The effects of humic acid solutions on concrete or Portland cement tile is merely a blackening of the outside of the formation of lime humate. I have never known of any further action of humic acid."

By the expression "properly made cement tile" we mean that carefully chosen aggregate, clean and well graded should be used in the mixture and that the proportions, methods of mixing, forming and curing should be such as to produce a tile of maximum density and strength. With careful attention to these factors, cement drain tile will give satisfactory service in muck ground.

Cementing Oil Wells as a Problem in Cement Chemistry

By Frederick W. Huber

The problem of excluding from the oil sand any waters encountered in the drilling of an oil well, is one with which the majority of operators have had to do. The various mechanical appliances and methods for placing the cement need not be considered here. Perhaps too much thought and ingenuity have already been expended upon things mechanical, to the neglect of the chemical factors entering into the problem.

In reviewing the various methods for cementing, one cannot but be impressed with the total absence on the part of the operator of any knowledge of the chemical and physical characteristics of the material he is using. Where this knowledge is not entirely lacking, one finds the operator proceeding along entirely empirical lines. The element of "luck" seems to be the governing factor in cementing oil wells.

ening in the environment in which the cement finds itself at the bottom of an oil well, are not, as may be supposed, very simple. The fact that a cement will either harden, or refuse to harden, in a well, is a statement in itself simple, but the cause for which will, what to the lay reader may seem, be going far afield. Before the problem can be solved the chemical and physical nature of portland cement must be understood.

Physical-Chemical Nature of Portland Cement

Much confusion exists as to the difference between cement in the dry state and the cement gauged with water. Portland cement clinker, which is the result of calcining the accurately proportioned raw mixture of limestone and clay materials, possesses no hydraulic properties whatever. The clinker can be kept under



Interior of Black Rock Cofferdam, Showing Concrete Ship Lock Erected up to the Last Section. Lackawanna Steel Sheet Piling Shown on the Left.

The writer knows of no attempts having heretofore been made to scientifically study the conditions existing in an oil well and their effect upon the hardening of the cement. He has, it is true, known of elaborate analyses having been made upon the various brands of cement to determine their present composition. Such tests have only served to bring out the already well known fact that the composition of various brands of portland cement vary only within very narrow limits, and that the analyses throw no light whatever upon the manner in which the various constituents are combined.

A problem must first of all be understood before it can be solved.

The problem of cementing an oil well, from a chemist's standpoint, is to allow the cement to harden properly. The conditions necessary for proper hard-

water indefinitely without undergoing any chemical change or manifesting any tendency to "set up," but upon having an adequate surface developed by grinding, it rapidly reacts with water, and the resulting reactions bring about the familiar phenomena of hardening or "setting up."

Dry cement is essentially a supersaturated solid solution of lime, silica, alumina and iron, and its structure is principally crystalline. Upon being mixed with the necessary amount of water its crystalline components are dissolved, and there results a colloidal complex. The reactions which will take place in this colloidal complex are dependent entirely upon the environment in which it is placed, and the end product will either be entirely insoluble or relatively soluble, depending upon the factors influencing it during the hardening process.



General View of Self-Contained Pocket Cofferdam, as Constructed by U. S. Government in Niagara River, Black Rock, Buffalo, N. Y. Concrete Walls of the Ship Lock Completed.

From the very nature of colloids, it is to be expected that the presence of electrolytes will exert a profound influence upon the end product. The end product of the reaction taking place in a favorable environment is the formation of an insoluble product from the colloids (hydrosols) by being properly coagulated into hydrogels. The first reaction taking place in a cement mortar is the formation of a skeleton of crystalline products by the combination of lime, alumina and iron.

These products viewed under the microscope present needle-shaped and hexagonal crystal forms. It is important to note that the silica does not enter into this initial reaction. The formation of this skeleton of crystalline material is necessary to set in motion the reactions which subsequently take place, and when cement is allowed to harden under favorable conditions, the end product is not crystalline, but amorphous. If, however, the cement hardens in an adverse environment, the products will be almost entirely crystalline; but by established physical chemical laws, it is known that crystalline products are relatively soluble.

A cement hardening by crystallization alone can serve as a binder where it is protected from the solvent action of water.

A cement which refuses to "set up" in an oil well and is subsequently removed, presents to the casual observer the same appearance that it had at the time it was deposited, but a closer microscopic examination will reveal an entirely changed structure, and it is possible that the cement did harden or "set up," but that the products of the reaction were decomposed as quickly as formed.

For the proper hardening of a cement by the formation of an insoluble hydrogel by coagulation, the reaction will be controlled by the factors—temperature, pressure and concentration, and in the final hardening by this process, the silica and lime alone bring about the reaction and give to the mortar its peculiar properties.

On the network of crystals that we have mentioned above, there separates a gelatinous mass of hydrous silicic acid. This compound immediately starts to adsorb the lime hydrate, which is immediately formed upon adding water to the cement. During this process of adsorption the hydrous silicic acid gel undergoes an enrichment in lime which chemically combines with it.

No compounds of definite composition are, however,

formed, as this fixation of lime proceeds indefinitely, and it is to this process of adsorption that the growth in strength of portland cement is to be attributed. During this process of adsorption there is formed around each grain of cement a semi-permeable diaphragm through which the pure water passes, but which does not permit the passage of dissolved salts (the principle of dialysis). The water so entering further into the cement grain again produces a local dissociation, and the whole process is repeated indefinitely up to such a point at which the outer layers of the semi-permeable diaphragm become so dense by the adsorption of lime and its fixation, that they become impermeable, and the hardening is completed.

A very striking proof that this is the condition which exists, is to be had in the regrinding of neat cement which has been "set-up" for some time. By grinding such a hardened mortar to its original fineness, we can develop a fair percentage of its original strength, which is to be explained by the fact that we have opened up and exposed to the action of water the unattacked portion of the cement grain. The product formed by the adsorption of lime by the hydro-silica gel is amorphous. The hydro-silica gel, however, can adsorb and fix many other electrolytes. When the cement mortar is placed in water impregnated with a certain class of salts, the salts are adsorbed and fixed by the hydro-silica gel with the formation of crystalline compounds, and the end product is soluble.

The conditions in an oil well are so far removed from those existing above ground, that it is safe to say no cement can be prepared which would fit all of the varying conditions. It is important, however, that the cement be of such physical constitution as to make it possible to react and properly harden in the treated water within the well.

The writer has in his operations in the oilfields used a specially prepared oil-well cement made for him by the Riverside Portland Cement Co. He does not wish to convey the impression to the reader that all oil wells need to be chemically treated. He has had no experience whatever on wells which could be cemented by the ordinary methods in use. He has, however, had to do with a great number of wells which have heretofore defied all previous attempts to shut off the water, and he has invariably found that by so modifying the conditions of concentration in the well water and the protection of the cement by the addition of a protective colloid, that he has brought about the desired result.

Medusa White Portland Cement for Ornamental Work

Portland cement has proved superior to all other building materials in strength, convenience, durability and cheapness, and has practically supplanted them in all heavy construction, but its unattractive color has prevented its use in the higher class of ornamental work.

Gypsum plaster in various forms, such as Keene's cement, has been largely used for interior work, but has proven unsatisfactory for out-door use through its inability to stand exposure to weather. Certain slag cements, and the "grappier" cement, made by grinding the residue of hydraulic lime manufacture, are nearly white in color, and have been considerably used

and then scrubbed with water, a texture is produced which rivals natural stone. Pure white floors, wains-coating, reliefs and stair-cases can be obtained by the use of Medusa white, while its use with white crushed marble for monuments, vaults, columns, urns, and plot borders in cemetery work, after washing off the finished product with dilute muriatic acid produces a sparkling effect rivaling that of the best white marble. It is unexcelled for fountains, seats, railings, walks and gate-ways for parks and grounds.

The exterior of the rough walls of the California State Normal School, San Jose, Cal., are covered with a pebble dash of Medusa white Portland cement. This



Fountain and Court, Residence of C. E. Finley, Kensington, Great Neck, Long Island.
Medusa White Portland Cement Used.
Stone-Steel Company, Builders, New York and Albany.

in Europe, but are so far inferior to Portland cement, in strength and hardness, as to have given little satisfaction.

Experiments made by S. B. Newberry, vice-president and general manager of Sandusky Portland Cement Company, Sandusky, Ohio, have finally produced Medusa White Portland Cement of pure white color, and equal in strength and other qualities to the best gray Portland cement. This company has built a special factory for the manufacture of this product, and for the past six years has been shipping it in large quantities, to the universal satisfaction of customers.

Medusa white cement is guaranteed to be a high testing Portland, passing standard specifications, and is the first true white Portland ever manufactured. It is shipped in duck sacks, returnable, or in paper lined wooden barrels, of standard size for ordinary Portland cement.

Medusa white Portland cement will be found suitable for building ornamentation such as steps, columns, doorways, window casings, cornices, panels and for stucco, statuary, tile, mosaic, stainless mortar for laying up Bedford limestone, sandstone or marble. For concrete building blocks Medusa white Portland can be used in conjunction with Medusa waterproofing for facing or entire body of absolutely damp-proof hollow concrete blocks, of pure white color or any desired tint. White limestone or crushed white marble and Medusa white Portland cement produces effects which give the appearance of solid blocks of white marble, and if the surface is washed with dilute muriatic acid

work was completed about two years ago and is said to be the largest re-inforced concrete school building, in ground area, in the world. Because of its immense proportions and unusual exterior treatment it is attracting world-wide attention.

Over 5,000 barrels of Medusa waterproofed white Portland cement was used in the Woolworth building, New York City, the highest office building in the world, while the United States Government has used Medusa in the Senate office building, National mu-



A Very Beautiful Concrete Bridge, Rochester, New York, Medusa Stainless White Portland Cement Used in Its Construction.

seum, New York City post office and many other post offices and buildings. The Isthmian Canal Commission has just placed an order for 1,000 barrels of Medusa stainless white cement for delivery in April at Colon, Isthmus of Panama, for government work in the Canal Zone. This product was also used in the ornamental concrete work on stadium of Polo grounds of New York National League Baseball Club, and in the construction of H. R. H., the Prince of Wales' racquet court, Marlboro house, England.

Free samples and booklets illustrating and describing some of the work in which Medusa white Portland cement was used, and containing tests and testimonials, will gladly be furnished on request.

THE DESIGN AND CONSTRUCTION OF REINFORCED CONCRETE OIL TANKS

Reinforced concrete structures are said to have been first introduced into Europe by Joseph Monier about forty years ago. His first attempt was the construction of tubs for holding plants and shrubs. Since that time reinforced concrete has been applied to the building of water reservoirs and large tanks for holding liquids and also solids such as cement, coal and grain. Today, such structures are rapidly superceding steel construction, and in the near future one may look for concrete to take the place steel has held in the past with storage tanks.

Four reinforced concrete tanks rectangular in shape were built last fall for the Queen City Oil Company, of Toronto, at their West Toronto yards. These tanks were for the storage of the lighter products of petroleum. They are, to the knowledge of the writer, the first of their kind to be built in Canada. The design and construction will be dealt with briefly as follows:

Owing to the confined space, the tanks were placed side by side, but each independent of the other. The general inside dimensions for each tank were 21 ft. 6 in. wide by 38 ft. long and 9 ft. 6 in. high. The total length of the four tanks was 94 ft. by 40 ft. wide. They were placed under ground and a covering of three feet of earth was placed on top of them. The tanks are filled by gravity from tank cars on a siding that runs into the yard. Two manholes were placed in each tank through which the intake and discharge pipes run. A tile drain, surrounded by broken stone, was placed around the bottom of the walls draining into two sumps, one on each side in the center of the four tanks. Square reinforcing rods of medium steel were used throughout the job.

Each tank was built separately and entirely independent from the other. A wet mix was used of a very strong concrete rich in cement. The walls and floor were poured continuously. This was done to form a homogeneous mass. As soon as it was thought advisable the forms were stripped and cement grout painted and troweled onto the green concrete. After the walls had hardened sufficiently the roof and supporting column forms were placed and the roof slab was poured. Gravel was used in preference to stone on account of the dense formation gravel concrete will give.

The contract called for a water test to be put on the tanks. This was successfully carried out to the satisfaction of the oil company and the contractors.

Similar tanks have been constructed for the Standard Oil Company in the United States, and have proved to be very efficient, economic and safe.

The reinforced concrete tanks for the Queen City Oil Company were designed and built by the Foundation Co., Limited, of Montreal, L. W. Klingner being superintendent in charge of the construction.

CONCRETE BRIDGE RESISTS FLOOD

In response to a long felt need for a wagon bridge over Harmon Creek, between Colliers and Hollidays Cove, the County Board of Brooke County, West Virginia, determined on a concrete arch bridge.

A unique feature is the construction used to resist the thrust due to arch action at the toe. This has been accomplished by embedding a block of concrete in the gravel foundation to a depth of four feet below the stream bed, and by attaching tie rods to the arch reinforcement at the haunch of the arch and extending them across the bed of the stream to the opposite arch rod. These tie rods are protected from rust by a 12-inch concrete pavement. The arch ring, the spandrel wall, and the parapet walls are fastened together by dowels. Before placing the parapet walls the arch centering was struck in order that the resulting settlement might not tend to crack the guard rails. The bridge has a clear span of 60 feet, a rise of 7 feet, 10 inches, and a clear roadway of 14 feet between the side rails.

Less than a month after completing the bridge, a cloud-burst occurred over the water shed drained by Harmon Creek. The resulting flood carried houses, barns, sheds, and finally, the railroad embankments.



Hollidays Cove Concrete Arch Bridge, Left Practically Intact After a Large Flood.

The terrific force of the water may be realized by the fact that two stationary locomotive boilers, which stood just west of the bridge, were moved over fifty feet and overturned. A house on the bank was thrown from its foundations, and, after being carried two hundred yards, was torn to pieces when it finally reached the railroad embankment.

The crest of the flood passed about four feet over the parapet walls. As shown in the illustration, the only damage done to the bridge was the breaking off of the guard rails and the spalling of the sharp edge of the upstream end of the arch barrel. The dowels were bent like so many small wires. Part of the gravel at the upstream toe was washed out, but not to a sufficient depth to undermine the structure.

The bridge was designed and built by Daniel B. Luthen, Designer and Engineer, Indianapolis. The manner in which it withstood the flood is conclusive evidence of the strength and adaptability of concrete for bridge construction.

SAND PUMPS

Erie Sand-Gravel Dredging Pumps and Erie High Duty Centrifugal Pumps are the titles of Bulletins 27 and 28, issued by the Erie Pump & Engine Works, Erie, Pa. Copies will be sent to readers of Cement and Engineering News.

Old-Fashioned Waterproofing vs Modern Impervite System

By Ralph L. Shainwald, Jr.

The progress of science has changed many old customs of building and design. The methods of our school days are being supplanted by improved processes that are simpler, cheaper and more reliable. In the field of waterproofing, the old "Membrane" method is being rapidly supplanted by the modern "Impervite" method.

The "Membrane" method consists in applying several layers of pitch and felt to the wall and floor. This is then covered with extra masonry to hold it in place against the force of the water pressure, and to prevent accidental tearing or puncturing of the felt. This old construction requires double walls and double floors, with the attendant expense of extra labor, extra material, extra excavation and loss of space, but in spite of all this trouble and expense, the method is scarcely ever absolutely reliable.

will "give," thus taking care of settlement. This is true for short periods and slight settlements, but every architect knows of membrane jobs which *have* failed because of settlement.

A serious menace to membranes arises from the gas mains in cities. All gas mains collect a kind of pungent oil, which frequently gets out through leaky joints in the mains, saturating the ground over immense areas. This oil absolutely destroys membrane waterproofing, as it dissolves the pitch and turns the felt into soft mush. An example of this kind of trouble was found at the Horton Ice Cream Company's building, shown on page 2 of the Impervite Booklet.

We have referred above to troubles which result in spite of care on the part of the waterproofer. Sometimes, however, the direct cause of failure is due to



Pierce-Arrow Building, New York, Waterproofed With Impervite, After Failure of Tar and Felt Membrane.

Frequently the membrane is damaged during construction, by tools, sharp stones or traffic, and the injury often escapes notice because the black pitch underneath shows up the same color as the scratched or torn felt. When completed, the very act of covering the membrane with its protecting wall is frequently the source of injury. If bricks are laid, a hasty jab of the trowel may destroy the future watertightness. If concrete is used, the dumping and tamping may tear a hole.

An important point of construction is that the backing wall of the membrane must be a solid retaining wall in cases where more than 2 or 3 foot head of water is encountered. We have known of many cases where backing walls have been thrown down or pushed out. One example is at the beautiful home of E. G. Woods, at Larchmont, N. Y., and another is at the Fire House shown in the accompanying views.

Then again, if the brick backing-wall is not *evenly* bedded in mortar against the membrane, experience shows that the water pressure will burst the membrane where this lack of backing makes a cavity. The membrane without backing is not strong enough to stand pressure, except over a very small area.

We frequently hear the claim that a membrane

faulty workmanship, but this depends largely on the character, standing, and experience of the contractor. A contributory cause of trouble often arises when the General Contractor rushes the waterproofer unduly, in order to get the protecting wall on top of the membrane and proceed with further construction. In other words, the membrane workmen must be sandwiched between the masons, just as the membrane itself is sandwiched between the masonry. In practice this always results in mutual delays, leading sometimes to dangerous skimping of the work.

If a membrane is injured by any of the above causes, then the most serious drawback of the system is encountered. Namely, the leak in the membrane is usually inaccessible from the outside, and cannot be gotten at from the inside except by removing the backing-wall, after putting the building on temporary foundations. To make matters still worse, you can't tell *where* to begin tearing out the wall. This is because the water is likely to travel a long way between the membrane and the wall, so that the leaks on the inside may be fifty feet from the leak in the membrane. Under most conditions it is practically *impossible* to repair the membrane. Then the builder, sadder but wiser, resorts to the use of an integral waterproofing compound to cure his trouble by the application of up-to-date science.

*Manager, The Standard Paint Co., 100 William St., New York, N. Y., Manufacturers of "Impervite" Waterproofing.



Fire-House, Long Island City, in Which the Backing-Wall of the Membrane Waterproofing Was Pushed Out by the Water Pressure, Causing Failure.

The modern method of waterproofing cellars, pits, tunnels, etc., is simple and reliable. It consists in plastering a $\frac{3}{4}$ -in. layer of Impervite Cement Mortar to the leaky walls. This method has been used to repair scores of buildings after failure of pitch and felt.

A typical case of membrane failure was at the Nepperhan Valley Pumping Station, Yonkers, N. Y. Here the pump pit, 30 ft. diameter by 30 ft. deep, was built of heavy concrete waterproofed in the center of the 36-inch walls by 9 piles of asphalt felt, well bedded in pitch. The bottom of pit was subjected to 25 ft. head of water, and the waterproofing failed in spite of the many layers of felt used and the greatest care on the part of the contractor. To have repaired the membrane was impossible, but a facing of Imperative mortar on the *inside* did the trick.

Again at the Pierce-Arrow building, the pump-pit, 28 ft. below high water level, was waterproofed with $\frac{3}{4}$ -in. of Impervite mortar, after the membrane had failed.

The Impervite cement mortar will bond to the *inside* of leaky walls, even where the tide-water or ground-water is pressing from the outside. We do this work any depth below water-line, under absolute guarantee. Full directions for the application of Impervite, under both mild and severe conditions, are contained in a book of instructions, which we have copyrighted. It is the only complete book of its kind published.

The greatest advantages of Impervite waterproofing (manufactured by the Standard Paint Company, Impervite Dept. K, New York, N. Y.) arises from the fact that a *thin* layer of Impervite mortar will waterproof against the highest pressure and that this will bond to the inside of a wall so firmly that it cannot be pushed off. The whole strength of the main wall and the main floor foundation is utilized by the waterproofing. This means that there is no further need of

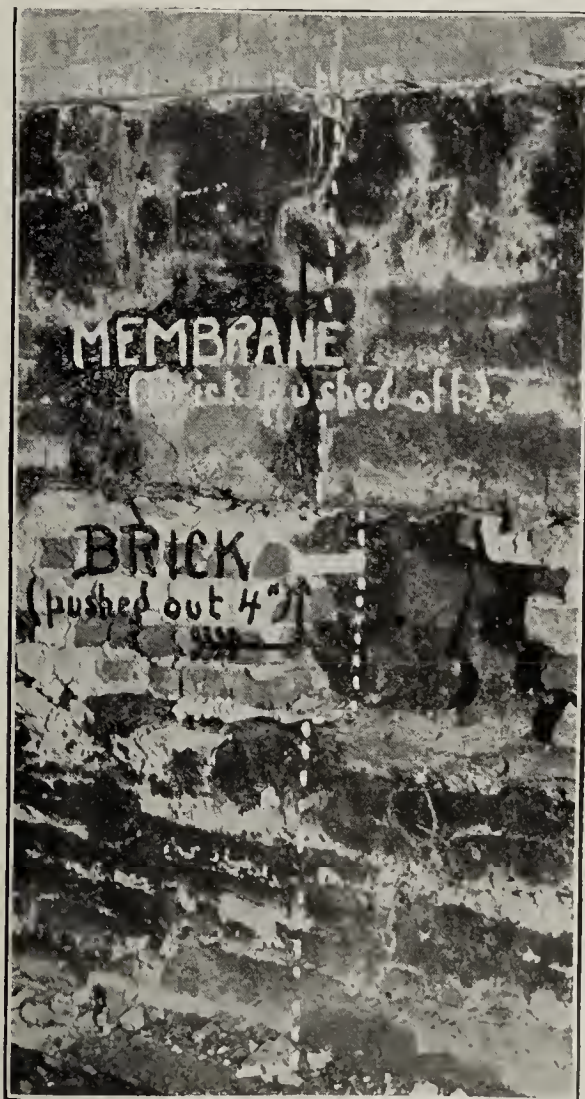
double walls or double floors to keep the waterproofing in place. All the expense of the extra excavation and construction is saved. The gain in space is a very valuable feature, especially in congested city streets where real estate is high.

By being able to construct the wall without interruption from waterproofers, the mason finishes his single wall much quicker and easier than if he had to build a double wall with pitch and felt in the middle. The contractor starts work above ground much sooner and with greater peace of mind; the whole building operation is hastened, because after the contractor is "out of the hole" he has comparatively smooth going.

The contractor need not start his inside waterproofers until the other masons have cleared out. Then the waterproofers can come in and work under advantageous conditions, while construction goes on above. The waterproofer has much more freedom when working on the inside than he would have if working in the foundation trench. The increased facilities for applying the waterproofing tend to improve the character of both the workmanship and the inspection.

The interior face is open and above board during and after the application. If the building should settle at any time, or if the installation of new pipes or partitions should break the water-proof layer, it is very easy to replace it at the point where it is injured. The waterproofing is always in sight and under control, and in addition gives a sanitary inside finish without expense for other plastering. It is not injured by gas-oil, brine, hot water, steam or ordinary chemicals. It serves as long as the building stands.

In conclusion, the summary of experience points to one lesson. Don't invest in a "Membrane" which *may* hold, but which, if it does fail, can only be repaired by the Impervite method. Use Impervite right at the start. Why run the risk of paying twice for your waterproofing?



Inside of Cellar Wall in Fire-House. Most of the Backing-Wall Collapsed, After Being Pushed Out 4 Inches. The Dotted Lines Show How the Backing-Wall Keyed Into Main Wall.

SAND-LIME BRICK

By Jefferson Middleton*

The sand-lime brick industry has been established in the United States since 1901, when the first plant was started at Michigan City, Ind. Since that time it has passed through the various stages of a new industry. In the beginning it suffered severely from the "boomer," on whose glittering promises to make brick for a few dollars a thousand that would sell in competition with high-grade face clay brick plants were established for the manufacture of sand-lime brick, without regard to market, transportation facilities, or even a supply of suitable material. Some plants constructed under these conditions never even attempted to market their product. Then came the natural reaction when the number of the plants and the value of the product decreased even more rapidly than commercial conditions would have seemed to warrant. Since that stage, within the last few years,



Michigan Reformatory's New Factory Building. Architects, Wernette, Bradfield & Mead, Grand Rapids, Mich. Construction work by the prison authorities. Building is inside the prison walls at Iona, Mich. One building 376 ft. by 75 ft., three stories, and two one-story buildings 80 ft. by 60 ft. and 140 ft. by 50 ft., respectively. 600,000 sand lime brick for outside manufactured by Grande Brick Co., Grand Rapids, Mich.

the industry seems to have become firmly established and is now showing a reasonable growth.

In common with most new building materials, sand-lime brick has had to overcome prejudice in the minds of some architects and builders. This prejudice was sometimes justified by the poor brick resulting from ignorance or lack of technical skill. The plants making this poor material have either gone out of business or have improved their product, so that to-day at many places sand-lime brick is successfully meeting the competition of clay building brick.

The condition of the sand-lime brick industry in the United States in 1913 was on the whole encouraging. The number of active operators reporting decreased, and four States that reported production for 1912, dropped out of the list of producers in 1913. On the other hand, the quantity of brick reported and its value increased, and the average value also of output per plant increased from \$16,905 in 1912 to \$18,211 in 1913. When this material was first produced in the United States, it was thought that many applications of it would be made, such as wall coping, ornamental pieces for garden and lawn, window sills, trimmings, lintels, columns, and capitals. None of these have been made extensively, although some attempts were made to produce them. The tendency has been, how-

*Department of the Interior—U. S. Geological Survey, Washington, D. C.

ever, to eliminate these special forms and uses and to make only building brick. For 1913 only the production of building brick was reported to the Survey.

The sand-lime brick industry showed progress in 1913 over 1912. In 1913 the value of the output reported attained its maximum, \$1,238,325, or \$12,556 more than in 1907, the year of maximum value prior to 1913. Compared with 1912, this was an increase of \$38,102, or 3.17 per cent. In 1912 the value of sand-lime brick products increased over 1911, \$302,559, or 33.71 per cent. The average value of output per active plant in 1907 was \$13,040; in 1913 the average per plant was \$18,211. Of the 24 States reporting production in 1913, 15 showed increase and 9 decrease. The increase was not confined to any one section of the country; the decrease was principally in the smaller producing States.

Value of Production of Sand-Lime Brick in the United States, 1903-1913.

Year.	Number of Operating Firms Reporting.	Value of Product.	Year.	Number of Operating Firms Reporting.	Value of Product.
1903.....	16	\$ 155,040	1909.....	74	\$1,150,580
1804.....	57	463,128	1910.....	76	1,169,153
1905.....	84	972,064	1911.....	66	897,664
1906.....	87	1,170,005	1912.....	71	1,200,223
1907.....	94	1,225,769	1913.....	68	1,238,325
1908.....	87	1,029,699			

This table shows that the value of sand-lime brick marketed and the number of operating plants reporting rose rapidly until 1907. In 1908 there was a decrease, in common with other industries. In 1909 and 1910 there were slight increases. In 1911 the lowest value was reached (\$897,664) since 1904. In 1912 and 1913 there were gains in value, the total for 1913 being the maximum, though the number of active firms reporting was 3 less than in 1912.

A LIGHT BATCH MIXER WITH HOIST ATTACHMENT

The small batch mixer is demonstrating every day its efficiency on construction work. Of especial interest in this development of small batch mixers is the way in which some of them are equipped with a hoist which will handle effectively and economically practically all the material the mixer can turn out. The American Cement Machine Co., 9635 Johnston street, Keokuk, Ia., now has on the market a low-priced batch mixer which is equipped in this way. The cut in their advertisement on another page in this issue of Cement and Engineering News shows the essential features of this mixer. The drum is of the standard type, chain driven. The gasoline engine with which the mixer is equipped has a surplus power. As to the hoist in particular, the drum is made of clear iron and holds 500 feet of $\frac{3}{8}$ -inch hoisting cable. The hub is hollow for oiling. The expanding arms and rim made of cast steel, and the clutch develop good gripping power and distribute the wear and the strain.

This drum has been recently improved so that there is but one lever for the clutch, release and brake. This new type of drum control is, the manufacturers state, an advantage in that it is impossible to leave the clutch in and throw the brake on at the same time. In the very nature of the case, this equipment must be handled by more or less unskilled mechanics and every feature making for simple handling merits consideration.

This mixer is equipped with a side-loader also. The bottom of the side-loader when lifted is nearly vertical, making for easy discharge. When the mixer is used there is an extra jack-brace which locks the hopper in the lifted position.

**Don't Shrink-
Don't Stretch-
No Take-up**

Machine Stripping Coal in Illinois

Goodrich
LONG LIFE MAXECON
CONVEYOR BELTS

reduce tonnage costs

The rubber covers on Goodrich Conveyor Belts are tough and durable. They resist abrasion. They protect the body of the belt from the inroads of alternating dampness and dryness.

Goodrich Belts won't shrink or stretch. They do not require a power-eating weight to maintain tension. They do not necessitate idleness for frequent repairs, adjustments or renewals.

Goodrich Products

Conveyor Belts
Elevator Belts
Transmission Belts
Hose—All Kinds
Packing
Valves, etc.

Advise us regarding installations. We make belts for every purpose

The B. F. Goodrich Co.

Factories:
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**Branches in All
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*Makers of Goodrich Tires
and Everything
that's Best in Rubber*

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rich Advertising that
isn't in Goodrich Goods*



Supremo Conveyor Belt

Adapted for all general requirements such as conveying gravel, cement, clinkers, crushed stone, grain, clay, wood-pulp, salt, tailings, etc. It is far above the so-called standard belt, and one that has given general satisfaction under more than ordinary conditions.

There is a diversified list of uses for Conveyor Belting. We have carefully studied the different conditions and materials and stand ready to construct a belt for the duty to be imposed, which is often of an abusive character. Conveyors for hot cement, hot coke or slag, crushed stone, silica sand, etc., represent a few of the extreme cases.

MANUFACTURED BY

Revere Rubber Company
Chelsea, Mass.

BESSER'S CONCRETE BLOCK MACHINE

In the past few years, there has sprung up a large demand among contractors and the smaller block makers, for an adjustable block machine of dependability at a low figure. Of the many machines offered to fill this demand, none has met with greater success than the wonderful little Besser Face Down block



machine manufactured by the Besser Mfg. Co., 406 Fourteenth st., Alpena, Mich. We take pleasure in presenting to our readers this month a picture and brief description of the outfit which has sprung into such popular demand.

One can see at a glance that the machine is sturdy and strong, built for years of hard service—which is characteristic of all machinery put out by this pioneer concern. It is an Automatic Vertical Core Block machine of the very latest type, and is adjustable to all sizes up to 8x10x20 in.—any combination of length and width. If your first outfit consists of 8x16-in. plates, and you later wish to make 20-in. blocks, all you need to add is the plates of desired length, and machine adjusts to suit them. If you wish to make a different width, you have merely to buy the end doors and cores to suit.

Any outfit makes veneer blocks in any thickness, watertable blocks, and a great variety of other work, without the addition of any extras at all. In fact, the range of work of the machine is practically unlimited up to its maximum size, as it takes all of the "Besser" face and end plates, which cover just about anything desired.

Mr. Besser makes a strong feature of his core design, which has distinct advantages. It is not neces-

sary to put in material and tamp before inserting core. Insert core first (unless special facing is being used), and the tamping between cores of this shape produces an intensely hard block. Of course, cores can as readily be inserted after the first tamping, in the usual way; but the Besser idea cuts out one operation, which means money saved for the user.

Either wood or iron pallets may be used, four set screws adjusting pallet bracket for any thickness up to 2 inches. Customers who desire to use iron pallets



will be furnished with a pattern at small cost, from which they can have their pallets made at home, thus effecting quite a saving.

This Besser Face Down Automatic Vertical Core Block machine is extremely easy working and rapid, owing to its simplicity and perfect balance, combined with its small number of operations per block. It cannot fail to interest any contractor or block manufacturer who wants a thoroughly good and efficient outfit, always ready to turn out high-class work, and just the right size to be readily moved from job to job. At the low price placed on it by this manufacturer, the "Besser" should become one of the greatest sellers in this line that has ever been brought out.

The Besser Mfg. Co., 406 Fourteenth street, Alpena, Mich., have just issued a new catalogue describing their concrete block machine, and showing by series of photographs the simple and rapid operation of making a block on it; also their automatic tampers, brick and tile molds, etc. This catalogue may be obtained free by addressing them at Alpena, Mich., 406 14th street.

C. W. BOYNTON

Mr. C. W. Boynton, formerly with the Baltimore & Ohio Railroad, and for the past ten years Inspecting Engineer of the Universal Portland Cement Co., is resigning his position to undertake a new line of work on the Pacific Coast. The Sonoma Magnesite Co. is developing its properties in California and Mr. Boynton will take charge of construction and operation.

Mr. Boynton for some time has been a member of eighteen or more prominent chemical, engineering and contracting associations, and during that time has served as chairman or member of a dozen or more committees dealing principally with cement and concrete. His work has always been held in high regard by those associated with him and particularly by the company by which he has been so long employed. Within the ten years in which he has been actively interested in the cement industry, he has organized and developed the Information and Inspection Bureaus of the Universal Portland Cement Co. These Bureaus have now a national reputation. With him go the best wishes of every one with whom he has come in contact in his various endeavors.

Mr. W. M. Kinney, Assistant Inspecting Engineer, who has been in charge of the Universal Inspection Bureau in Pittsburgh during the past six years, will take up the work which Mr. Boynton leaves.

STEAM SHOVEL CHAIN

The Columbus Chain Co., Columbus, Ohio and Lebanon, Pa., manufacture a very high grade chain for use on all makes of steam shovels, which they call their "Hercules" solid weld steam shovel and dredge chain.

This chain is made of a triple refined and reworked iron of the highest tensile strength, elasticity and hard-wearing surface, made to their own formulae. Only the most expert chainmakers are employed in making this chain.

They have been making this chain for a number of years, always aiming and striving to improve the quality, wherever it was possible to do so, both as regards the iron and workmanship. They now claim their "Hercules" solid weld steam shovel and dredge chain will more nearly meet the very exacting and strenuous requirements of the steam shovel user than any other chain made, and will give less trouble and much longer service. They have unsolicited letters from contractors and cement, gravel, sand, crushed rock and lime producers, claiming their chain lasts on an average fully 50 per cent longer than any other chain they have ever used.

We are also informed by them that the "Hercules" solid weld hoisting chains are to be found on the shovels on most of the big projects today, working day after day, and are giving the very best of service in every instance.

The best testimonial of the superior value of their hoisting chains is the fact that they sold more hoisting chains the past year than ever before. This would indicate that the steam shovel crews are fast learning that the "Hercules" solid weld steam shovel chain gives them less trouble, has fewer breakdowns,

less loss of time, etc., than with other chains, and insist on having this particular make of chain. Their chains are made in all sizes and they are fully guaranteed. Write them for their new catalog.

"OBSTITCH" DIAMOND REINFORCEMENT BELTING

For some time past there has been a growing demand by users of wide and heavy belts for the very best belt they can find, even though the first cost be greater.

With this incentive the Mount Vernon Belting Co., of Baltimore, Md., have devoted a great deal of time, work and study to perfect a belt that would meet every requirement in strength, adaptation and longevity, and in their "Obstitch" have accomplished this end.

The construction of the "Obstitch" with diamond reinforcement shows the best quality of material and workmanship in every part. It is made from a specially constructed cotton duck weighing 34 ounces to the square yard—weight positively guaranteed—and this extra weight, being added in the wrap threads, gives it a very high tensile strength.

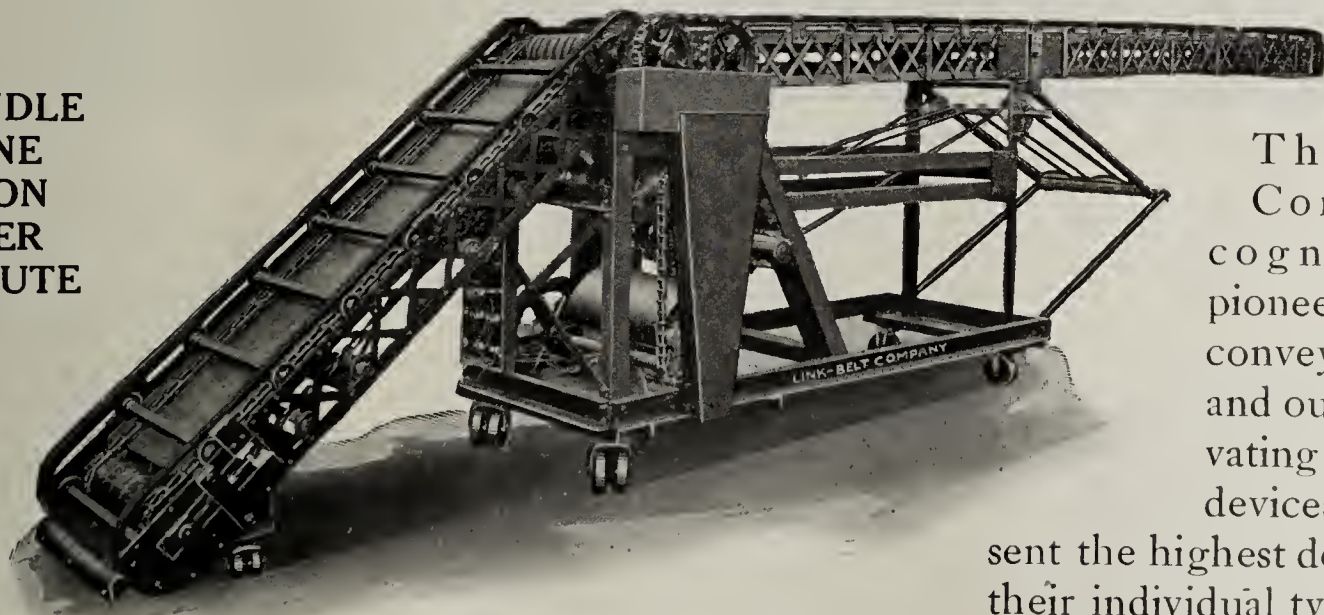
It is treated by two distinctive processes, making the belt an absolute water, alkali and acid resistant. The one for general transmission and carrying purposes is finished yellow, and the other, finished black, is treated specially for extremely hot places, such as carrying of hot clinkers, clay, etc.

The "Obstitch" has been subjected to the most severe practical tests against several of the oldest and most widely known textile belts in the world, with results that it gave from 75 to 100 per cent better service than any of them.

LINK-BELT BAG PILERS

Cut down handling costs and increase the efficiency of your men

HANDLE
ONE
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The Link - Belt Company is recognized as the pioneer in the art of conveying materials, and our various elevating and conveying devices to-day represent

the highest development of their individual types.

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Buffalo.....698 Ellicott Square
Birmingham.....General Machinery Co.
Seattle.....512½ First Avenue, S.
Denver.....Lindrooth, Shubart & Co.

San Francisco.....N. D. Pelps, Sheldon Bldg.
New Orleans.....Whitney Supply Co.
Los Angeles.....204 No. Los Angeles St.
Detroit.....911 Dime Bank Bldg.

PORTABLE BINS FOR CONCRETE AGGREGATES

Because of the economy of handling cement in bulk, a portable storage system for handling cement, sand, gravel and crushed stone has been devised by the Weller Manufacturing Company, of Chicago. The system consists of a number of bins into which the materials are deposited by a bucket elevator. These bins are built so that no danger of damage from rain exists. The capacity of the bins is one carload or more, and the aggregates are fed by gravity to the mixer below. For batch mixing, measuring devices can be fitted to the chutes or the materials can be directly spouted into the hopper. For continuous mixing, automatic feeding devices can be attached to spouts, regulated to deliver varying amounts from the different bins at the same time.

By this arrangement maximum capacity can be reached, as the unloading from cars can be accomplished at the most convenient time and a large supply of material is constantly on hand and available by operating a lever. After finishing one job the equipment can be taken down, shipped to another point and quickly assembled. The machinery can be

CAR UNLOADER

The Link Belt Company, Philadelphia and Chicago, have recently placed upon the market a car unloader, built either movable or stationary. Two or three men will unload a car of loose material at the rate of 50 tons per hour, at a cost of 1½ cents per ton, as compared with employment of 8 to 10 shovelers at a cost of from 8 to 10 cents per ton. The machinery consists of a heavy elevator on a steel frame, hung on the end of a boom, which may be lowered and raised in and out of the car by means of a wire rope and winch. The material, fed to the buckets by shovelers in the car, is delivered by means of a steel spout to a second fixed elevator which fills the bin. The distinct advantage of using two elevators is, first, it decreases the weight of the hinged part, and second, the material may be spread on the ground at each side of the pocket as a reserve storage, if possible. Prices, blueprints and all necessary information will be mailed, free of charge, on request. Mention Cement & Engineering News when writing.



Bucyrus Shovel Operating in Dolese Brothers' Crushed Stone Quarry at Legrand, Iowa.

operated by motor, gas or steam engine or any other available power. These storage systems can be built all steel or all wood, or a combination of steel and wood.

CYCLONE DRILLS

The Cyclone Drill Co., Orrville, Ohio, has recently issued a very interesting booklet, comprising 78 pages, entitled "Cyclone Hollow Rod Tools." The Cyclone company are builders of drilling machinery for coal, water, oil, gas, placer, sounding and boring blast holes for quarry and railroad work of the hollow rod and cable type. The booklet consists, in great part, of descriptive matter contained in the Cyclone company's book, "Drill Work, Methods and Cost," which gives a splendid treatise on the subject of hollow rod tools and complete instructions for their operation. In the booklet just issued will be found many photographic reproductions of the tools in use, together with appropriate description. A considerable part of the booklet is devoted to parts.

STONE QUARRIES

Dolese Brothers are operating a 110-ton Bucyrus shovel in their crushed stone quarry at Buffalo, Iowa. The Universal Crushed Stone Company use a Model 70 Bucyrus steam shovel for loading crushed stone at their quarry in Racine, Wis. The Universal Company also use "Clipper" drills made by the Loomis Machine Company of Tiffin, Ohio, for drilling the blast holes, and they declare they are well satisfied with their equipment.

TEMPERATURE MEASUREMENT IN KILNS

The Thwing Instrument Company, 451 North Fifth street, Philadelphia, Pa., has recently sold to the Tidewater Portland Cement Company, Union Bridge, Maryland, a four-record temperature recorder to be used on their rotary kilns. The Thwing Company has also shipped an eight-record outfit to the Louisville Cement Company, Sellersburg, Ind. The cement industry is waking up to the importance of temperature measurement at last.

Lansing Broncho Batch Mixer

\$200 and
up.

Sizes 7 to 10
15 Cu. Ft. Capacity

Better Than the Best

Only costs a fraction as much.

New 1914 Models

Here's the new 1914 Model Lansing Broncho—"The Daddy of All Mixers." A strong, powerful mixer that is better than the best and only costs a fraction as much. Not a cheaply made machine at a cheap price; but a high grade, first class mixer at popular price. A machine every contractor will be proud of. Strong where strength is needed. High wheels for easy moving; low intake for quick, easy loading, high discharge for wheelbarrows or forms. Easily cleaned; quickly and easily moved. Equipped with all of the latest and most modern devices, and built on the most modern and sensible lines, combining few wearing parts with great strength and speed.



**No Other Mixer
Combines all of These Features**

Low charging for wheelbarrows or shovels. Measuring hoppers for those who want them. Side loaders for big jobs; high discharge for wheelbarrows or forms; simple, strong, powerful engine; non-slopping rings; quick mixing principles; ball and socket fifth wheel for short turn, and to avoid racking of frame on uneven ground; few wearing parts for economical up-keep; high wheels for hauling steel drum; machined bearings; steel channel frame; friction clutch for starting and stopping; quick mixing, cleaning and dumping principles. Most mixers have some, but the Broncho combines all of them—the most satisfactory machine made from every required standpoint.

**1914 Models Are Marvels
of Strength and Speed**

They produce a quality of mix that every inspector accepts and pronounces *good*, doing it at most satisfactory rate of speed—600 batches and over per day, if required. Discharge operated instantly without the usual slopping. Mixer is reinforced, braced and strengthened at every possible wearing point. Machined track and bearings; channel iron frame (cross and corner braced), insuring the longest possible life and greatest wear. Designed to carry loads of from 1,000 to 5,000 pounds of concrete every batch, 10 hours a day, and 365 days in the year. Adopted by the largest and most exacting contractors in the country.

We Also Manufacture

Continuous Mixers
Mortar Mixers
Hand and Power Mixers
Block & Brick Machines
Ornamental Moulds
Tools Barrows Carts
Scrapers Sand Screens
Mortar Hods
Mortar Trays, etc.

Send for Catalog

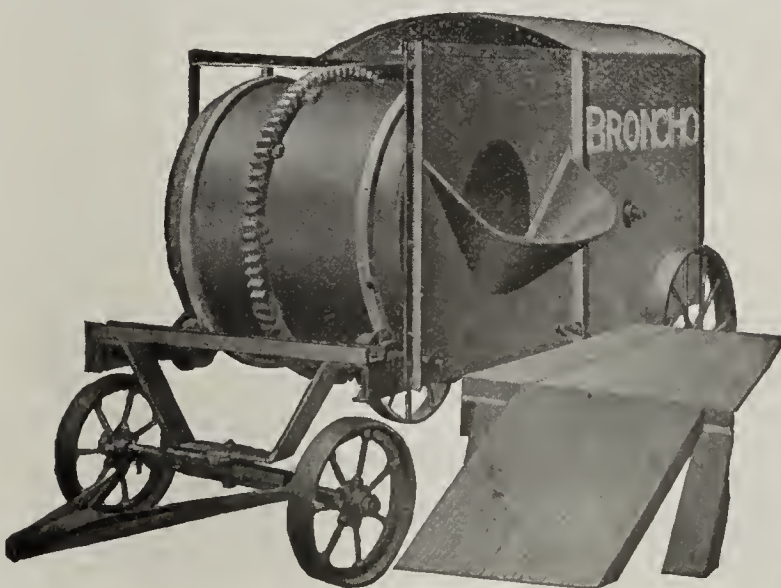
The Lansing BRONCHO is Truly the Biggest Value Ever Offered.

You don't buy mixers every season and you don't have to with the Broncho. Every dollar saved in equipment is so much more profit, and profits are what mixers are built for. Why invest in a cheaply built machine when you can get a well built, long wearing, well designed machine at the same price? Don't be content merely with a cheap mixer, but get a good mixer at a low cost. Do not invest a dollar in a concrete mixer until you have learned more about the Lansing Broncho. It is truly the biggest value ever offered in good machinery at low prices.

LANSING COMPANY
747 CEDAR ST. LANSING, MICH.

Branch Houses

New York Boston Philadelphia
Chicago Minneapolis
Kansas City San Francisco



BOOK REVIEWS

General Specifications for Concrete and Reinforced Concrete, including Finishing and Waterproofing, by Jerome Cochran, B.S., C.E., M.C.E. pp. xxiii + 274; Nostrand Co.; 1913; \$2.50 net. Sent on receipt of price by Cement and Engineering News, 1117 Schiller Bldg., Chicago, Ill.

This book is the latest of a series, by the same author, dealing with concrete construction and allied topics. In his preface, the author states that there is yet room for individual work in the field covered by his book, in addition to the valuable work already accomplished by the committees of the several engineering societies, for no other reason than that there still remain quite divergent views not only as to the substance, but also as to the form, scope and phraseology of specifications. The purpose of the book is expressed as an endeavor toward producing a set of specifications that will be of increasing influence for good concrete construction.

The subject matter is divided into nine chapters and the treatment is exhaustive and detailed, a considerable amount of space being given over to bibliographies and references. Detailed precautions to insure good work and guard against all possible contingencies are given and are very complete and in conformity with good practice. This feature should make the book of value to the engineer of limited practical experience in concrete construction, both in the writing of proper specifications and in superintending work. However, he should guard against allowing his enthusiasm over good specifications to carry him to unnecessary refinements, which may increase the cost and retard the progress of the work without appreciable increase in quality. Emphasis

should be laid on the fact that it is not wise to adhere too closely to any set of specifications, but to judiciously compile a set for each particular job in such manner as to attain the desired quality of work at a minimum cost.

Chapter I deals with Concrete Materials, giving the usual specifications for cement, sand, broken stone and gravel. Chapter II takes up the Proportioning and Mixing of Concrete; Chapter III, Forms and Centering, and Chapter IV, Steel Reinforcement.

Chapter V on the Transporting and Placing of Concrete; Chapter VI on Finishing Concrete Surfaces; and Chapter VII on the Waterproofing of Concrete Work are well presented and give many valuable suggestions. Chapters VIII and IX give the elements of design and details of construction for various types of reinforced concrete work and are in general conformity with standard practice.

The arrangement and presentation of the subject matter is excellent and readily referred to, although much of it could be condensed and duplication avoided.

RENEWO VALVE

The Lunkenheimer Company, of Cincinnati, Ohio, will send a copy of their latest booklet describing the Lunkenheimer "Renewo" valve to any of our readers upon request. This valve embodies all the good features discovered and developed in over half a century of valve manufacture. It is a renewable seat, regrinding valve adapted for high pressures. All parts are renewable, particularly the seat and disc, which are subjected to the greatest wear and which are made of a high nickel alloy.

THE BISHOP PATENT DERRICK EXCAVATOR

FOR HANDLING SAND, DIRT, GRAVEL, CRUSHED STONE, ETC.

There are only two machines that will dig material that is met with, and they are the steam shovel and the dipper dredge. By using the Bishop Patent Excavator, any derrick having a rectangular or a square boom can be converted into a steam shovel or a dipper dredge made out of a derrick boat.

This apparatus can dig anything a steam shovel will dig, and

its range is from the base of the derrick to the end of the boom and below the base of the derrick the length of the dipper arm.



WHY KEEP AN EXPENSIVE

steam shovel at work at the pit excavating sand and gravel when lower-cost equipment will do the same work? With your regular derrick you can dig material from the bank, you can excavate earth, you can handle loose materials on the construction job.

The Bishop Patent Derrick Excavator is an attachment that is readily adjusted on your derrick. It consists of a carriage traveling on the boom, a dipper and a dipper arm. A square or rectangular derrick boom, a double-drum engine and swinging gear are required. One man operates the equipment.

UNION IRON WORKS

HOBOKEN,

ERIE SIDING,

NEW JERSEY

Among The Cement Mills

THE PRODUCTION OF PORTLAND CEMENT IN 1913

The total production of Portland cement in the United States in 1913, as reported to the United States Geological Survey, was 92,097,131 barrels, valued at \$92,557,617; the production for 1912 was 82,438,096 barrels, valued at \$67,016,928. The output for 1913 represents an increase in quantity of 9,659,035 barrels, or nearly 11.72 per cent, and an increase in value of \$25,540,689, or 38.11 per cent. The value assigned to the production is proportionate to the value of the Portland cement shipped in 1913.

The shipments of Portland cement from the mills in the United States in 1913 were, according to reports received by the Survey, 88,689,377 barrels, valued at \$89,106,975, compared with 85,012,556 barrels valued at \$69,109,800, shipped in 1912. The shipments therefore represent an increase in quantity of 3,676,821 barrels, or 4.31 per cent, and in value of \$19,997,175, or 28.94 per cent. The average price per barrel in 1913, according to these figures, was a trifle less than \$1.005, compared with 81.3 cents in 1912. This represents the value of cement in bulk at the mills, including the labor cost of packing, but not the value of the sacks or barrels. The average price per barrel for the country is about 16.7 cents higher than the average price received for Portland cement in the Lehigh district, where it was sold at the lowest price, and is near the average price received in Illinois, Indiana, and Missouri, but falls 45.6 cents below the average price received on the Pacific coast, where Portland cement brought the highest figure during the year.

The quantity of Portland cement produced, 92,097,131 barrels of 380 pounds, is equivalent to 15,623,620 long tons, and the value per long ton is \$5.92. Compared with the production of pig iron for 1913, 30,966,152 long tons, the Portland cement production is nearly 50.5 per cent of the quantity of pig iron, but the total value of the cement does not greatly exceed 20 per cent of the value of the pig iron. The value of the cement per ton is about 40 per cent of that of pig iron.

The average price of Portland cement in the United States has been increased slightly over the average for ordinary gray cement by the inclusion in the total of 160,582 barrels of white Portland cement, valued at \$2.34 a barrel. The greater part of this white cement was produced in the Lehigh district, so that the value for that district has been increased in greater proportion than that of the other districts. Three mills produced white Portland cement in 1913, 1 being in California and 2 in Pennsylvania, 1 of which produced white cement exclusively.

NEW ELECTRICAL EQUIPMENT.

The Crescent Portland Cement Co., Wampum, Pa., has ordered for power plant equipment a 2500 kv-a. Curtis turbo-generator with switchboard apparatus.

The Alpha Portland Cement Co., Philadelphia, Pa., will add electric apparatus to the equipment of its plant, including four 1000 kw. rotary converters, four 1050 kv-a. water cooled transformers and a switchboard.

NEW STORAGE BIN

The Dixie Portland Cement Company, Richard City, Tenn., are building a new storage bin which will have a capacity of 46,000 barrels of cement.

ILLINOIS IS OUT OF THE MUD

Two hundred miles of hard roads are to be built immediately throughout the state of Illinois under the Tice Law, which gives state aid to each of the 102 counties for building better roads. Governor Dunne, and an efficient State Highway Commission, after aggressive interest in this subject have at last succeeded in getting every county in the state to accept the state aid.

Illinois has ranked twenty-third in the matter of good roads and yet has paid the second largest road tax. It has been a subject of vital importance to every citizen in the state, not only on account of the unnecessary taxation, in connection with these poor roads and their up-keep, but it means that the farmer may market his product more cheaply—that the now isolated farmer children will have an opportunity for better education—that community houses will be made possible—that the country wife and mother can visit their city neighbors, and that altogether it will bring the farmer and his family in closer touch with the people of the city.

In connection with the good roads success, the largest single order for cement ever given in the state of Illinois, was awarded for Marquette Portland Cement in the amount of 1,600,000 sacks. This is surely a reward of merit. The Marquette Cement Manufacturing Company has gained a reputation for supreme quality of product, and prompt and courteous service, and these points could not be overlooked when the Highway Commission selected the material for this big contract. Their selection means much to every user of cement. It means that unprejudiced and competent judges made a selection that should be a guide to everyone who uses cement and wants the best, whether it is only a single sack or a carload.

If we are making an effort to reduce our road tax to a minimum we cannot afford to take chances on inferior material. The Highway Commission are to be congratulated on their upholding of quality in selecting Marquette Portland Cement.

The citizens of Illinois owe a debt of gratitude to Governor Dunne and the Highway Commission for their efficient aggressiveness in putting the state of Illinois among the first states in the Union in the matter of good roads.

GRAVEL AND ROCK PLANT

J. A. Dewar Company, Ltd., 119 Pender street, Vancouver, B. C., have a sand and gravel plant with capacity of 500 yards and a crushed rock plant, capacity 100 yards daily, and they write that the Bucyrus steam shovel which they use for loading their material is giving entire satisfaction; also their McCully crusher and Koppel dump cars.

COLUMBIA QUARRY

The Columbia Quarry Company of St. Louis, Mo., inform us that they are well pleased with the No. 31 Marion steam shovel which they employ in their quarry at Columbia, Ill., for stripping. They also use five Gates crushers, Allis-Chalmers screens and two Jeffrey vibrating screens, which give entire satisfaction.

WANTS POSITION

An experienced Portland cement mill man wants a position. Has worked for 25 years in all capacities, such as chief chemist, operation of quarries, superintendent, general manager, purchasing agent, etc. Address S. E., care Cement and Engineering News, 64 W. Randolph street, Chicago.

HYDRATED LIME

FOR WATERPROOFING CONCRETE

As an actual waterproofer hydrated lime is not surpassed by any of the compounds at the present time used for this purpose.

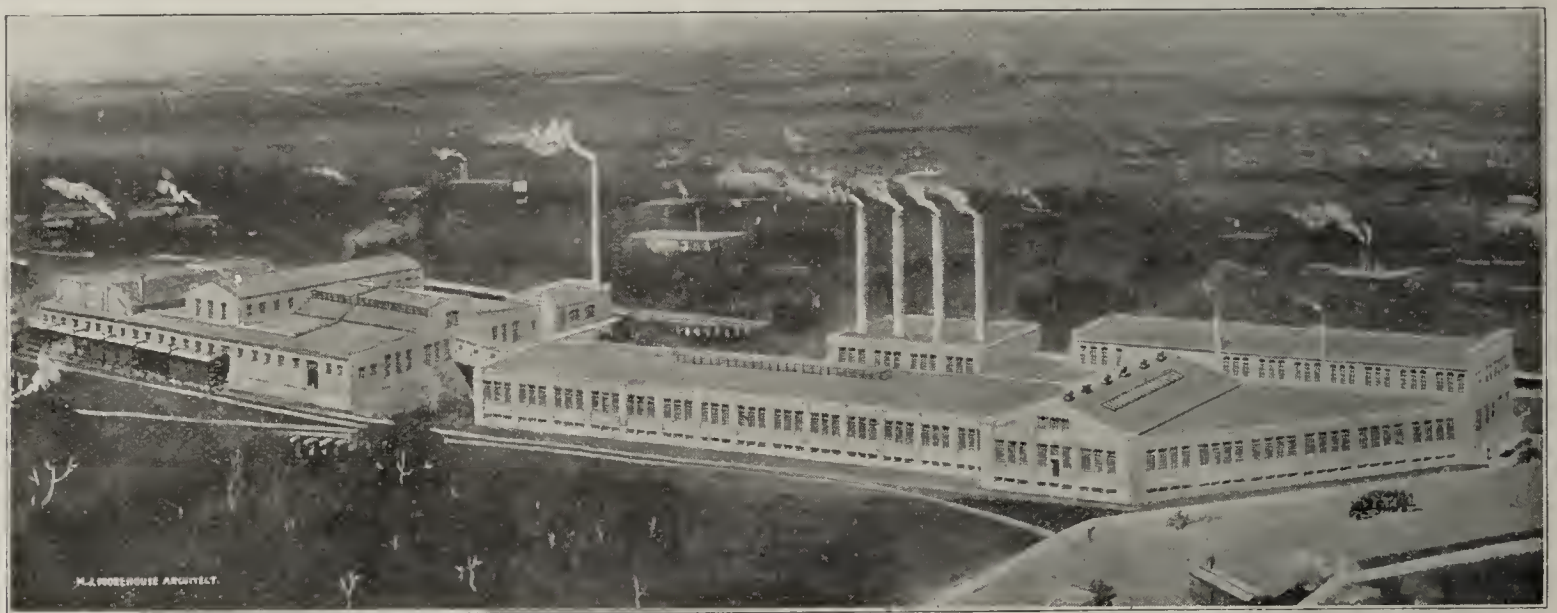
Hydrated Lime is being demanded by engineers, architects, dealers, manufacturers, contractors and builders everywhere. It can be manufactured now as cheaply as quick lime and it possesses certain properties making it more useful and valuable to builders than ordinary quick lime. It requires, however, great care and extra machinery in the manufacture of hydrated lime.

Hydrated lime is shipped in bags the same as cement, making it easy to handle for both the contractor, dealer and manufacturer.

Hydrated lime is a fixed product which does not deteriorate with age, and therefore may be conveniently stored at either the plant or dealer's warehouse. This cannot be done with quick lime.

It has long been known that additions of lime improved in a great many ways cement mortars, notably the trowelling and waterproofing qualities of these latter. Since hydrated lime comes on the market as a very fine, dry powder it can very conveniently be mixed with cement.

It is usually employed in proportions of about fifteen parts of lime to eighty-five parts of cement, or 15% of the cement is replaced with lime; hence for each bag of cement used, seventeen pounds of hydrated lime are added, the mixture thus making as much concrete as 1.2 bags of cement. The addition of this lime to the cement has several other important advantages. Chief of these is its waterproofing qualities. The theory is very simple. Hydrate of lime is an extremely fine material being much finer than the finest Portland cement; hence the material fills the voids in the concrete mass, making a denser and therefore more nearly waterproof substance. Most waterproofing materials have an organic base, and therefore are ultimately subject to decay and disintegration. While these organic salts at first render concrete watertight, in time thru decay they leave the mass as porous as it would have been had no waterproofing compound been added. Hydrated lime is practically pure calcium hydrate, is of mineral nature, contains no organic material and is, therefore, not subject to decay or disintegration.



To protect a basement of 31,500 sq. ft. of floor space against an eight or nine foot head of water, was the problem that confronted the builders of the plant, shown above, the magnificent home of the Michigan Carton Co., Battle Creek, Mich., completed in 1911.

The basement of this plant is 14 feet high, 75 feet wide and 420 feet long. The building stands on very low, marshy ground, on what was formerly, in fact, the bed of the Kalamazoo River. At present, however, the stream has been diverted and flows like a mill race, in times of high water, between the main buildings. At such times the water rises to a depth of 8 or 9 feet above the floor level and the rear wall of the basement must act as a retaining wall against the flood.

"Hydrated Lime" was the happy and effectual solution of this difficult problem and the interesting facts are given by Mr. M. J. Morehouse, the well-known architect of Chicago, who had charge of the work.

The floors and walls are of concrete, both waterproofed, the latter up to a height of 10 feet. The mixture used was one part cement, four and one-half parts of sand and gravel and seven to eight per cent, by weight of cement of "Hydrated Lime."

Severe as was the test on the outside of the building, within we have one equally as severe and much more constant, in the form of fourteen concrete tanks used in the Company's operations.

The tanks range in size from 8' x 18' to 12' x 40' all 14' deep. The walls are 12 inches thick and of the same mixture as the outside walls. From 5 to 8 feet of water stand in them constantly and sometimes more.

There is room for thought in these facts. Absorption and leakage have been and still are the real faults of underground concrete. How simple and yet how effective was this treatment. Only 7 and 8% of "Hydrated Lime," a companion material of the Portland Cement with which it was used.

Since completion, the building has been subjected to an inundation of 8 or 9 feet without the slightest ill effect, while the tanks are a constant evidence of the efficacy of "Hydrated Lime" when properly used with Portland Cement.

See next page for list of Lime Manufacturers who make Hydrated Lime and who will gladly furnish you circulars and any information you desire.

WHY DEALERS SHOULD ADVOCATE BULK CEMENT

One of our dealers recently sold 10,000 barrels of cement to be used in the construction of a reinforced concrete factory. The arrangement was that the cement should be shipped direct to the contractor, who would take care of all the unloading and handling of the material. The cement, which cost the dealer \$1.75 a barrel, was to be invoiced to the contractor at \$1.83, making a gross profit of 8 cents a barrel, and the dealer was to handle the returned sacks.

An interesting point arose in discussing this subject with the dealer. 10,000 barrels of cement at \$1.75 would call for a total investment of \$17,500, on which his profit would be \$800 gross, or a little over 4½%. It will be noted that 40 cents of the price of each barrel was for cloth sacks, on which the dealer had to spend his money and collect from the contractor just as in the case of the cement. We suggested to the dealer the possibility of helping to persuade the contractor to use bulk cement. If bulk cement is used the investment will be \$13,500, and the \$800 profit will amount to over 6% return on the investment. Furthermore, the 6% profit on the bulk cement transaction will be net, because there will be no sack handling expense or possible losses due to sack disputes to charge against it. If this job is handled with sacked cement, the 4½% profit that will be possible under such conditions will not be a net profit, because the sack items will have to be deducted from it.

Whenever cement is being used direct from the car to the mixer, and at the rate of half a car a day or more, it is to everyone's interest to have it handled in bulk. We have just shown how profitable bulk cement would be to the dealer in a case of this kind. The contractor himself can undoubtedly save at least

5 cents a barrel in handling bulk cement where conditions will permit of its use. If a man has the bulk cement proposition put up to him in the right way, he will have to be very hard-headed if he refuses to agree to the reasonableness of it, and it has been our experience that the trial of a single carload of bulk cement will convince a bulk cement user that it is to his advantage to handle the material in that form.

We would recommend that our dealer-customers give this question their serious consideration, and if they find among their trade a man who ought to be handling his cement in bulk, that they give us a chance to help convince him that bulk cement is the thing he should use.

WOULD LESSEN WEIGHT OF BAG OF CEMENT

Several manufacturers of cement have expressed an opinion that an 80-pound bag would be the practical size for both cloth and paper; that the unit of weight could be established for a 400-pound barrel, five sacks to the barrel or twenty-five sacks to the ton. The proportions or divisions by sacks would then be simple and logical.

This would relieve the overstrain on the present 95-pound paper packages and on all handlers of the present 95-pound bags of cement; would largely obviate the annoyance of the breakage of the paper package; would lengthen the life of the cloth sacks, and also aid the packing house crew to become more efficient and better contented, their work being quickened by relieving them of 15 pounds on each package. This would not overstrain their muscles or exhaust their energy; they can return to work each day refreshed, because they can rest over night from a hard day's work, when not overburdened.

HYDRATED LIME

Its Marvelous Increase in Consumption

is due to its successful and growing use in various kinds of cement work. It is only necessary to mix the two and any desired proportions can be employed. For laying brick and stone a mixture of 25 parts cement and 75 parts hydrated lime is quite popular. (One bag of cement to three 100-lb. sacks of hydrated lime.) The addition of the cement does not appreciably detract from the plasticity of the mortar, while it adds greatly to the strength, particularly at early periods. For stucco, the proportions are generally reversed, (one 100-lb. sack of hydrated lime to three sacks of cement,) the hydrated lime adding to the plasticity of the mortar and making it spread more easily. It also makes a lighter colored stucco and adds to its density. For making concrete building blocks, about 15 parts of hydrated lime and 85 parts of cement are used (or one 40-lb. sack of hydrated lime to two sacks of cement.) It has been found that up to 15% of hydrated lime does not detract from the strength of cement mortars.

Write for printed matter, information, etc., to any one of hydrated lime manufacturers listed below—the nearest to your city

LONGVIEW LIME WORKS,
1116 AMERICAN TRUST BLDG.,
BIRMINGHAM, ALA.

CHARLES WARNER CO.,
WILMINGTON, DEL.

MARBLEHEAD LIME CO.,
159 N. STATE ST.,
CHICAGO, ILL.

SECURITY CEMENT & LIME CO.,
HAGERSTOWN, MD.

LEE LIME CO.,
LEE, MASS.

CHARLEVOIX ROCK PRODUCT CO.,
CHARLEVOIX, MICH.

GLENCOE LIME & CEMENT CO.,
915 OLIVE ST.
ST. LOUIS, MO.

DUTCHESS COUNTY LIME CO.,
SCARBOROUGH-ON-HUDSON, N. Y.

KELLEY ISLAND LIME & TRANSPORT CO.,
CLEVELAND, OHIO

NATIONAL LIME & STONE CO.,
CAREY, OHIO.

JOHN D. OWENS & SON CO.,
OWENS, OHIO.

NATIONAL MORTAR & SUPPLY CO.,
SECOND NATIONAL BANK BLDG.,
PITTSBURG, PA.

GAGER LIME & MFG. CO.,
CHATTANOOGA, TENN.

DITTLINGER LIME CO.,
NEW BRAUNFELS, TEX.

RIVERTON LIME CO.,
RIVERTON, VA.

INTERNATIONAL LIME CO.,
SUMAS, WASH.

STANDARD LIME & STONE CO.,
FOND DU LAC, WIS.

UNION LIME CO.,
PARST BLDG.,
MILWAUKEE, WIS.

Out in a little Ohio town the Norwalk Vault Company started some six years ago making the first crude models of their cement burial vault. Either by good judgment or by good luck, it seems they happened right at the beginning to get hold of the **fundamental** principles of vault construction. for in their very earliest work was found a happy combination of qualities that has enabled them to prosper where even their closest imitators have failed. And under the personal supervision of Mr. C. L. French, who is reputed to know more about burial vaults than any man living and his able foreman Diamon, the Norwalk product improved steadily every year.

Some Ohio Business Men

Never was a business more conservatively managed. The stockholders in the Norwalk Vault Company were the leading business men of Norwalk. These gentlemen took as much pleasure in the quality of the vault turned out by their little factory, as in the product of their own offices; they were as proud of the fact that the Company never failed to earn the cash discount on its bills as they were of their own clean credit. And even though they had already more agents manufacturing the Norwalk than all the other vault makers put together, the question of an active manager to succeed Mr. French, whose health permitted him to continue no longer, was rapidly becoming a source of grave concern.

A New England Undertaker

Just about this time there was, in New York, a young man born and brought up in the undertaking business. One day he ran across a model of the National Vault. From that time on he talked of nothing but the possibilities of the cement vault business. He took the model up to his father and brothers who have undertaking shops of their own. Finding them almost as enthusiastic as himself, he scraped together all the cash he had in the world and jumped on a train to Norwalk. It took him some days to persuade Mr. French and his associates that he was the proper man to keep the Company up to its high standards. But when he returned to New York he had in his pocket an option to buy the Company.

Getting Money and Men

To interest men with money it was necessary for the young undertaker first to prove that there was a field for a burial vault of **any** kind. Asking whether **they** would be willing to bury their wives or children in a mouldering wooden box, if **for any price** they could secure a clean dry air-tight moisture-proof vault, he quickly disposed of this point. Then he had to take up the question of cement vaults as against vaults of wood, slate, bronze, steel and other metals. Fortunately Mr. French had shown him how to demonstrate not only that properly prepared cement is cheaper, more moisture-proof, and far easier to manufacture, but that it is actually more durable and lasting. Another serious question was raised as to whether undertakers generally would be willing to handle a vault of this kind. The only answer here was that undertakers are business men; and that an opportunity to give satisfaction to his customer and get profit for himself, is the one thing all real business men are after. Furthermore, the young undertaker pointed out the fact that the prospect of permanence induces a greater investment in caskets, plates, handles, and brings the undertaker more money all along the line.

A Visit to the Cement Show

Lastly, was to prove the fact that the Norwalk product is enough better than any other cement vault to make perfectly safe an investment in its manufacture. By rare good fortune, the Cement Show was still running, and an hour's study of the exhibition there did more for Norwalk's case than a whole day of talk. Furthermore, there was a letter from a concrete man in New Jersey who had thoroughly investigated sixteen different vaults—and chosen the National, also an order from a firm at Westchester who had just completed a similar investigation.

Collecting the Experts

Having secured the necessary capital, the next thing was to get the right kind of men to join in the enterprise. Seeing the tremendous possibilities for development along broader lines, the new owners of the Norwalk Vault Company have interested a number of young business men in their new enterprise. So that besides a practical undertaker and a practical vault man, the company now includes a patent attorney, a certified public accountant, a sales expert, and two adver-

tising men. Except the first two, all of these are successful New York business men. Before any one sniffs at the idea of self-satisfied New Yorkers in a business of this sort, let us hasten to add that of the six men most directly interested in the Company, one comes from Tennessee, one from Connecticut, one from Pennsylvania, one from Nova Scotia, one from Virginia and one from Indiana—four of them from small towns. So there is really not much danger of the Company shooting its proposition over the head of the men outside the big cities.

And Now a Word with You

All along you have been wondering what sort of an advertisement this is. It is a straight out-and-out advertisement of the Norwalk Vault Company. There are two reasons for taking up so much space telling you about our buying of this Company; first because we hope it will be of a tiny bit of interest to you; secondly, because we hope it will make you understand better what we are going to try to do. Will you read on for just a few more words?

A Sleeping Infant

The cement industry, everybody agrees, is still in its infancy. If that is so, the cement vault business **isn't even born yet!** Just as cement is gradually replacing wood and metal in every kind of construction work, just so is the cement vault going eventually to replace all wood and metal containers. Not only that; but public opinion, once awakened, will no longer permit bodies to rot unprotected in the soil. The day is not so far distant when the great majority of all burials will be in some permanent and sanitary receptacle—and when that time comes, a great majority of these receptacles will be of waterproof cement.

Georgia and Michigan

This, in fact, is already the case wherever people know of the Norwalk Vault. One in every four funerals in his county is the record of a man down in Georgia; and out in Michigan is a man who furnishes a Norwalk Vault to **three out of every four funerals!** There are already 300 of these distributing centers scattered through the United States, and each new one opened adds to the value of all the others by making known more widely the merits of the Norwalk Vault. In this way a tremendous "good will" is slowly being built up all over the United States.

Short Cut to Profits

But there is a short cut—and that is advertising. So far as we can learn, the only reason the vault business is not one of the most important branches of the entire cement industry, is that the **public doesn't know about the cement burial vault.** There seems to be no trouble in the manufacture; almost any man can set up a little plant for the making of vaults, but it is not so easy to get the undertaker to handle them, or the public to buy them. This is where we hope to be of some service to the men who make Norwalk Vaults. Not that we expect to accomplish any spectacular "stunts" or to revolutionize any industries. But we do believe sincerely that the **SELLING** side of the cement vault business is at least as important as the manufacture. And we do hope eventually to work out some plans that will result in quick sales and big profits for every man that undertakes the manufacture of Norwalk Vaults.

How About Your Territory?

Have you thought anything about the possibilities of your own territory? The Georgia man, mentioned a few paragraphs back, clears \$5,000 a year profit; his original investment was a good deal less than one-fifth of that amount. Shouldn't your territory be at least as good as a small city in Georgia? If no one else has spoken for it, we would be mighty glad to take the matter up with you.

On September 1st, 1914

Finding that so many territories have already been assigned, and expecting to arrange for so many more this Summer, we plan at the very beginning of the Fall to raise the prices of the old Norwalk Company at least 25 per cent. By taking the matter up now, instead of next month, you may be able to save all along the line. Remember you are incurring not the slightest obligation in giving us an opportunity to talk this cement vault over with you; consider it rather a favor to us. Just write "I read your advertisement in the CEMENT AND ENGINEERING NEWS and would like to know more of your proposition" and mail to



The Norwalk Vault Company,

38 Siminary Street
NORWALK, OHIO

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for \$1.00;
all other countries, \$1.00 per year.

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CHICAGO, AUGUST, 1914

IS THERE A POWDER PLOT?

By E. G. Buckner

Vice-President, Du Pont Powder Company

Harper's Weekly recently printed two articles under the titles, "The Powder Trust" and "The Powder Plot," which grossly misrepresented the du Pont Powder Company and did it great injustice.

As a matter of fact there is no statement, inference or conclusion reflecting on the du Pont Powder Company in either article that is not wholly fallacious.

(1) It was intended that the readers of Harper's Weekly should be convinced that the du Pont Powder Company, in entering into a certain contract with German manufacturers, twenty-five years ago, violated the Federal statute and were guilty of a felony.

What are the facts? In 1889 Admiral Folger, Chief of the Bureau of Ordnance, Navy Department, convinced that the Brown Prismatic Powder manufactured abroad was superior to that used in our Navy, ordered the du Pont Powder Company to secure these processes. Armed with letters from Mr. Blaine, then Secretary of State, to our Ministers abroad explaining his mission, Alfred I. du Pont went to Europe and contracted for the right to manufacture this powder, compensation to be made by the payment of a royalty per pound on the powder manufactured until the same aggregated \$100,000. Thus our Government was not only familiar with the contract but a party to it, for it obligated itself to pay and did pay these royalties.

We did "keep the German manufacturer informed of the amount of powder manufactured for our Government." How would it have been otherwise when our Government was the only purchaser and we had to make an accounting for every pound of powder manufactured?

The records are public and I defy anyone to show from them anything justifying the astounding charge that the du Ponts in making or carrying out this contract were the "monopoly paid spies of a foreign government" and therefore guilty of treason.

This contract came to an end in 1898. It in no manner related to our present smokeless powder.

(2) It is charged that the du Pont Company, in selling to foreign governments the "identical powder used

by our own Government," betrayed government powder secrets and was thereby "guilty of a criminal offense."

The utter nonsense of this will be apparent when the fact is known that the du Pont Powder Company has never sold a pound of smokeless powder abroad without first consulting with government officials, and, in each instance, the powder sold has been tested by government officers at the Government Proving Ground.

There are no "powder secrets." The identical specifications on which the present Government powder is made are printed in a book published by Major Erasmus M. Weaver, of the Army, and on sale at bookstores. Likewise, the specifications on which cordite, Great Britain's powder, is made are printed and sold by authority of "His Majesty's Government." Almost any chemist could take the publications referred to and make smokeless powder, but I doubt if it would be made with economy.

Every European nation that manufactures powder sells the identical powder used by such government wherever it can, as it sells armor, battleships, guns and all other ordnance material. European nations even go so far as to detail their Army and Navy officers to go to other countries and assist their manufacturers in landing these contracts.

The development of the smokeless powder which we now manufacture for our Government covers a period of about thirty years. It originated in France in 1883 when M. Vieille produced guncotton adapted to the manufacture of smokeless powder. At once the world's inventors directed every effort toward devising some method by which this explosive could be utilized in guns. Mendeleef, a Russian, solved this problem and in a magazine article told how this guncotton might be colloided, that is, mixed into a plastic mass suitable to be pressed through a die. Lieutenant Bernadou, of the Navy, who was at that time abroad, returned home with this information and in conjunction with Admiral Converse took out patents on these processes in the United States. No powder was ever manufactured, however, successfully under these patents, nor under the patent of Charles E. Monroe whose work is mentioned in Harper's Weekly. Admiral Converse himself in printed Government reports has testified that the Government never bought any powder manufactured under the Bernadou patents.

It was recognized that the then known methods of manufacture were hazardous. Then it was that Francis G. du Pont invented and patented a process and machine for the dehydration of guncotton, that is, handling it in a wet state, that eliminated all danger, and as Admiral Strauss, of our Navy, says, "made the manufacture of smokeless powder a safe industry."

The next problem was the adaptation of this powder to guns of different caliber. This problem was solved by Hudson Maxim, an employee of the du Pont Company, who invented the multi-perforated grain; and the du Pont Company was given credit for it by Mr. Tracey, Secretary of the Navy, in his annual report to Congress.

Harper's Weekly observes that during these early days private manufacturers "had not been showing up very well." Let us see:

(First) Vieille had produced guncotton in France.

(Second) Mendeleef, of Russia, had told us how to colloid it.

(Third) Francis G. du Pont had told us how to eliminate danger in the manufacture.

(Fourth) Hudson Maxim, an employee of the du Pont Company, had invented the multi-perforated grain that gave absolute control over the burning.

It will thus be seen that of the four great steps in the development of smokeless powder, two stand to the credit of the du Pont Company. In rapid succession there followed valuable inventions which not only resulted in improving the powder but in reducing the cost—methods and devices for recovering alcohol, reworking powder, stabilizing the powder and more than doubling its life, nitrating guncotton, etc., which were worked out in du Pont laboratories and experimental plants and credit for which has time and again been given to the du Pont Company by Army and Navy officers.

The du Pont Company invented a Small Arms Powder, and a machine for its manufacture, the admitted value of which to the Government was greater than our aggregate profits on all the business we have ever done with the Government. The Government is manufacturing this powder with this machine while Congress, by limitations on appropriation bills, prohibits the purchase of this powder from the du Ponts!

It is the accumulated experience of decades that has given the du Ponts primacy in the manufacture of explosives, enabling them to work out processes, machinery and economies so essential to commercial success; and let it be known and remembered that every process and invention perfected by the du Ponts has been turned over to the Government, practically without cost, for use in its two plants!

With the above recital in mind, every item of which can be verified by official records, if there are any smokeless powder secrets, whose are they?

I would not have any one infer that I contend that Army and Navy officers have not aided in the development of our present smokeless powder, but I deny, nor will they contend, that the service rendered by them justifies the claim in Harper's Weekly as to Government secrets. They have tested and criticised and suggested. The du Ponts in their laboratories and experimental plants spent money and brought results.

(3) It would be made to appear that Senator Henry Algernon du Pont, who since 1906 has been identified with the Committees on "Military Affairs" and "Expenditures in the War Department" of the Senate, has been looking after the interests of the du Pont Company in Washington. This is ridiculous. Senator du Pont is neither an officer, a director, a stockholder, or an employe of the Company, nor has he been since elected to the Senate, nor has he ever made any effort to assist it in Washington. During the eight years he has been in the United States Senate the price of smokeless powder for large guns has been reduced six times, from 70 cents to 53 cents per pound; and such limitations have been placed on the bills going out of his Committees as to render it impossible for the Army now to purchase any powder from the du Ponts.

Now the foregoing statements, every one of which can be verified and substantiated by official records, establish the following facts:

(1) That the contract for Brown Prismatic Powder was made at the instance and with the approval of the Government.

(2) That if there are any smokeless powder secrets, they are du Pont secrets.

(3) That while Senator Henry Algernon du Pont has been Senator nothing advantageous to the du Pont Company has come from his Committees.

These facts being established, I submit that I am justified in contending that the charges carried in the two articles in Harper's Weekly are without warrant or excuse and are grossly and outrageously unjust and unfair.

Studies to be Made of Concrete Road Slabs and Stucco Panels Under Various Conditions

Plans are now in process of formation by the Bureau of Standards for broadening two important lines of investigation. The studies made last year in concrete roads, which indicated that expansion and contraction were due more to moisture content than to temperature, were carried on on slabs far removed from the headquarters of the bureau. Consequently measurements could not be made as frequently as desired nor at those special times when the readings might have had the greatest significance. Moreover, the slabs being laid under working conditions did not always represent the variables which it was desired to investigate.

It so happened that the bureau for some time had contemplated the laying of new roadway surfaces in its grounds at Washington and this plan suggested to Rudolph J. Wig, assistant engineer physicist in charge of cement investigations, that concrete slabs be laid under quite a variety of conditions. By having the specimens under test right at the bureau's door it will be possible to take observations several times each day through all seasons of the year, and also to give certain slabs special treatment in order to observe its effect upon expansion and contraction and the life of the slab.

The condition of the base will be varied, since expansion and contraction are influenced by the smoothness or roughness of the material under the slab. Some slabs can be kept constantly wet, while on all it will be possible to take not only strain gage readings, but also measurements of displacement movements and differences in elevation. Contracts for the laying of the pavements have not yet been let, but the plans are being rapidly completed.

Stucco Investigations

The second line of investigation deals with stucco. It is proposed, under the plans so far as now matured, to divide the investigation into three parts: (1) A study of experiences with stucco in all parts of the country; (2) search of the literature of the art; (3) tests at the bureau on panels of good practicable size.

On the panels to be constructed at Washington all of the important variables will be studied. The backing will be of metal lath, wood lath, tile, etc., the materials will be mixed in various proportions; the efficacy of waterproofing will be considered, and, in general, all of those factors included which experience or theory indicates are worthy of study.

The program is now in a formative stage and is being criticized by representatives of various interests, which are indicated by the list of members of the committee given below. In addition, practical plasterers are to be called into consultation so that there will be assurance that all classes which can aid in shedding light upon the matter will be represented.

The study will be under the general direction of Rudolph J. Wig, engineer-physicist of the Bureau of Standards. Working with him will be the following committee: W. E. Emley and J. C. Pearson, of the Bureau of Standards, the former having made investigations of lime and the latter of stucco; C. M. Chapman, engineer of tests, Westinghouse Church Kerr & Company; H. S. Spackman, of Philadelphia, who has long been interested in the production of Alca limes; W. E. Carson, president of the Lime Manufacturers Association; H. J. Brown, of the Gypsum Industries Association; H. B. McMaster, of the Associated Metal Lath Manufacturers, and L. R. Ferguson, of the Association of American Portland Cement Manufacturers.

The Decorative Possibilities of Concrete.

By C. W. Boynton and J. H. Libberton.

(Continued from page 179.)

A few years ago the theory of applying concrete by means of a hose and nozzle met with derision, but every day we hear of more work being done by this method, the machine being designated as the "cement gun" and the concrete "gunite." An interesting piece of work has been accomplished by the Boston Elevated Railroad at the foot of O Street, Boston, where a garden fence has been constructed by this method. The base and posts are built of concrete poured into the forms in the usual way, the posts being relieved

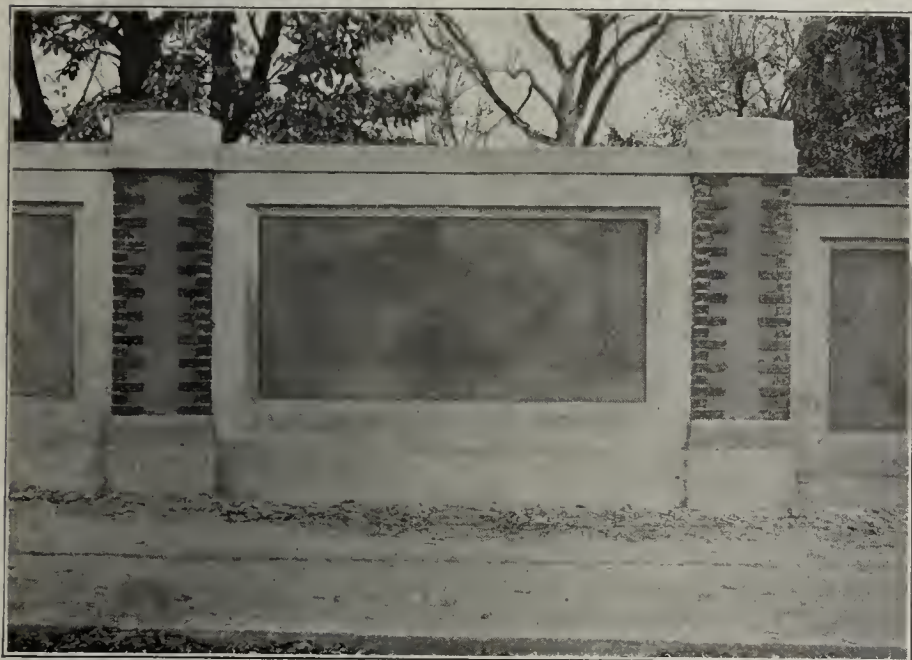


Fig. 17. Cement Gun Construction on Wall of the Boston Elevated Railway.

by protecting brick quoins (Fig. 17). The street face of the panels were shaped by means of a wooden form and each central panel was faced with steel. The concrete was applied from the rear with the cement gun, making the panels 2½ in. thick and the styles 4 in. thick. The interesting point in the operation is that the entire panels are made in one piece and at one operation.

The very fact that concrete is simple in operation has caused many to undertake construction who are in no way fitted to carry it out, but with proper supervision even the most unskilled laborer can accomplish pleasing results. This has been proved conclusively by the work of the Aberthaw Construction Company at Port Antonio, Jamaica (Fig. 18). The 56 columns for the structure were cast in sand molds, then put into a lathe and turned down and polished so as to expose the coarse aggregate. An intensely red coloring matter present in the natural aggregate



Fig. 18. Concrete construction in Jamaica, Showing Method of Elevating Concrete.

has given the walls a light salmon tint, which is very attractive. Particular attention is directed to the methods of elevating the concrete to the work, and judging from the smiling faces of the women shown in Fig. 19, the task does not seem to be over-tedious. For this hard labor they receive about 25c per day. Able-bodied men on the same work receive about twice this amount. Even with the lack of artistic appreciation which the people of this class possess, the building has been designed so as to be architecturally pleasing and will undoubtedly have its effect in educating the people to a better realization of what constitutes good architecture and design.

A building should be fitted to the country in which it is to be located, and more and more attention is continually being given to the unity which must exist between the landscape and the layout of concrete structures which are to be added as permanent improvements. A striking example of this is to be found on the Duke Estate at Somerville, N. J. (Fig. 20), where white concrete and white sand have been used in facing the concrete, in order, possibly, to give more



Fig. 19. Concrete Elevators on Construction Work in Jamaica.

contrast against the natural beauty of the surroundings. The bridge (Fig. 21) harmonizes with the rest of the work but might be improved if the surface markings were eliminated—the general lines accentuated by bush hammering, or some one of the other numerous interesting surface treatments, to which concrete may be subjected.

In a similar manner the concrete posts which have been added to the Lake Shore Drive in Chicago, not only add materially to the dignity and beauty of this boulevard but are, themselves, better set off by being so well located (Fig. 22). Imagine this particular design on South Clark and Harrison Streets. For a while the posts would look entirely out of harmony with their surroundings, but there is every probability that their advent would produce a desire on the part

of the property owners to clean up the streets and buildings so as better to accord with the dignity of the lamp standards.

A note on the method of construction of these poles may be of interest since they are of reinforced concrete, cast in one piece including the base (Fig. 23). The surfacing is made of a special mixture of cement, dark red Wisconsin granite, and a small amount of



Fig. 20. Concrete Retaining Wall and Balustrade on Duke Estate, Somerville, N. J.

mica, which is washed, after removing from the mold, with a weak solution of hydrochloric acid. The design is the result of a contest in the Chicago Architectural Club, the successful contestant being John Hamilton.

Of a similar nature is the work on the concrete railing around Jackson Park Harbor, also in Chicago (Fig. 24). Here, as before, the concrete depends for its beauty upon the surroundings rather than upon the excellence of the design, although it is well agreed that little could be added which would improve the dignity and solidity indicated by this superior example of a concrete railing. The white surface is obtained by the use of limestone screenings which emphasizes the important part the aggregate plays in determining the color of the concrete into which it enters.



Fig. 21. Concrete Arch Bridge on the Duke Estate, Somerville, N. J.

The attention which is being paid to the design of improvements which will harmonize with the surroundings may well be illustrated by the work of the B. & O. Railroad, on its Independence Boulevard Viaduct, Chicago (Fig. 25). A total of some twelve to fifteen different designs were prepared and only after careful consideration was one finally decided upon, which the railroad officials thought would be suitable to submit to the Park Board. How well they succeeded is evident. Were the plain steel structure considered by itself, a realization could be had of the tremendous improvement which has been effected by the simple ad-



Fig. 22. Lake Shore Drive, Chicago, with Concrete Lamp Standards.

dition of the reinforced concrete covering. Some of the earlier work of the B. & O. Railroad shows an entirely different method of handling concrete, depending upon inlaid tile for decoration rather than upon the excellence of the design (Fig. 26). Of course, as this bridge is located on West Ogden Avenue, Chicago, there is nothing in the way of beautiful landscape to mention and, probably the officials believed that a little brightening of the concrete surface would relieve the monotony of a busy business street. But work of this kind is extremely expensive and can best be illustrated by a comparison of this bridge with the Independence Boulevard structure which is of 250-ft. span.

The Ogden Avenue Viaduct is 135 ft. between abutments, and yet the cost of concrete finish and inlay tile was greater than the total for the other



Fig. 23. Steel Molds for Casting Concrete Poles.

structure of 250-ft. span. A similar structure has been designed for Sacramento Boulevard (Fig. 27), but as this street is much narrower than Independence Boulevard, naturally an entirely different method of treatment was necessary and the lines have been made to follow somewhat along the Mission style.

Concrete surfacing not only protects the steel, making painting unnecessary, but it improves the general aspect of the structure. This is well illustrated by a very unimposing viaduct in Pittsburgh which recently



Fig. 24. Concrete Railing Around Entrance to Jackson Park Harbor, Chicago.

was found to be rusting away for lack of paint. Feeling that the structure's existence was justified, the officials made arrangements to cover the steel with concrete, in much the same manner as has been used by the B. & O. Railroad, although no particular attempt was made at architectural effect. Nevertheless, the appearance of the viaduct has been improved and its life undoubtedly materially lengthened.

Another railroad which is paying particular attention to the appearance of its viaducts is the New York, Chicago & St. Louis Railroad, under the supervision of A. J. Himes, Engineer of Grade Elimination. In the majority of instances the attempts have been thoroughly successful, although at Maysfield Road,



Fig. 25. Independence Boulevard Viaduct, B. & O Ry., Chicago.

Cleveland, the structure may be questioned as to its pleasing architecture. A great number of arches with short columns has not only made a large amount of form work necessary but has hardly justified the expense involved.



Fig. 26. Ogden Avenue Viaduct, B. & O. Ry., Chicago, Showing Tile Inserts.

More pleasing work has been accomplished on the Euclid Avenue Bridge and at probably less unit expense (Fig. 28). In Cleveland also, attention has been paid to the combination of landscape with structure, as indicated by the East Boulevard Bridge (Fig. 29), which is particularly well located so far as the contour and beauty of the surrounding country is concerned. The color which has been added to the arch and abutments tends only to brighten the picture and improve the general impression. The paneling for this bridge has all been finished with a bush hammer and the red framing was obtained by mixing iron oxide with the concrete.

As has been stated, massive structures are impressive, irrespective of their design or location, but the interest is generally enlivened by such a waterfall and stream as is included in the photograph of the concrete bridge at Spokane, Washington (Fig. 30). The design is undoubtedly excellent and would stand alone, uncriticized, but the touch of romance which the scenery furnishes engages the attention and makes the picture more alluring than that of the Paulinskill Viaduct of the Lackawanna Railroad at Hainesburgh, N. J. Though equally well designed, it is surrounded



Fig. 27. Sacramento Boulevard Viaduct, B. & O. Ry., Chicago.

by uninteresting prairie on every side, which, of course, cannot by any means be charged against the bridge design.

Notwithstanding the excellent decorative work which has been done in plain and reinforced concrete, there are, nevertheless, numerous advocates of tile decoration. Instances are many where the use of brick or tile emphasizes the contour and enlivens the surface at very little expense. A little touch of color relieves the monotony of a single toned exterior and is illustrated in the seed warehouse of Otto Schwill



Fig. 28. Euclid Avenue Viaduct, New York, Chicago & St. Louis Ry., Cleveland, Ohio.

& Co. at Memphis, Tennessee. This building would undoubtedly be equally as efficient were it built without any attention to pleasing architectural effects. With the present leaning toward pleasant work rooms for employes, this idea has spread to the exterior with the result that our factories are surrounded by grass plots and gardens and the buildings themselves, so far as possible, are made to conform with the tendency toward providing pleasant environment.

The office building of the Packard Automobile Company at Buffalo, New York (Fig. 31), is an equally good example of the combination of concrete and brick, although the decoration is of cast concrete. Carrying this idea further, the Ford Automobile Company at Detroit, has not only built of reinforced concrete with brick inlay and corner towers but has called



Fig. 29. East Boulevard Bridge, New York, Chicago & St. Louis Ry., Cleveland, Ohio.

in mosaic tile to brighten up the panels under the cornice, and though the embellishment was achieved at some expense, the architect felt that the attention to this detail was deserved (Fig. 32).

Another example of the use of colored clay tile for concrete decoration is to be found in Minneapolis, where on the north shore of Lake Calhoun a large building has been constructed of reinforced concrete



Fig. 30. Concrete Arch Bridge, Spokane, Wash.

called the Calhoun Baths (Fig. 33). The central portion of the building is roofed and serves as the entrance, housing the ticket office, the rooms where bathing suits, towels, and keys to lockers are distributed, and the refectory. It also connects directly with the terrace above the bathing beach. The dressing rooms on the opposite side of the central portion



Fig. 31. Office Building, Packard Automobile Co., Buffalo, N. Y.

of the building are without roof but are fitted with concrete rooms and steel lockers in double tiers. In order to reach the beach, the bathers must pass through a pool of water and through a triple shower direct from above and from both sides, so that a partial wetting is received before reaching the beach.

(To be continued.)

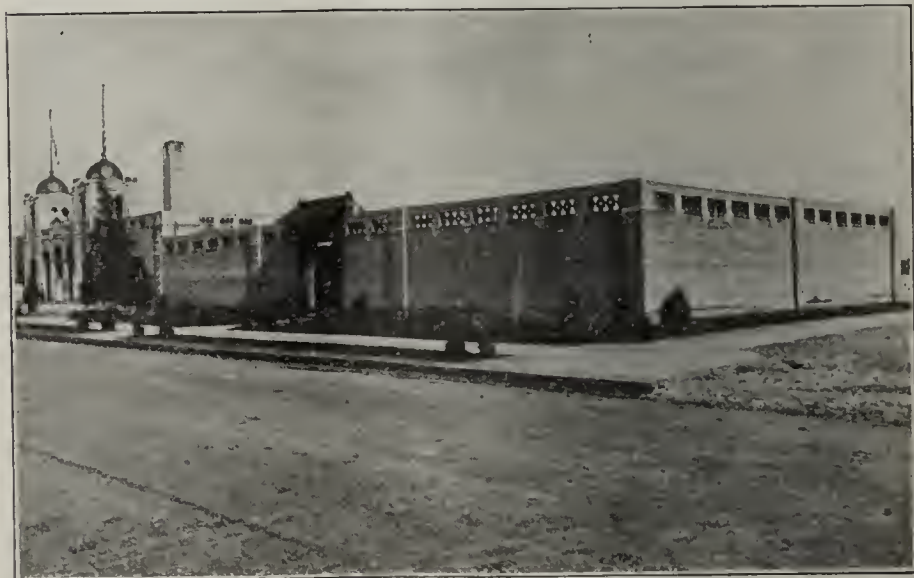


Fig. 33. General View of Calhoun Baths, Minn.

The Use of Hydrated Lime in Concrete Mixtures For Pavements.

By Robert S. Edwards, Consulting and Chemical Engineer, Portland, Oregon.

It is the purpose of this paper to show wherein certain materials, when put together carefully and correctly, serve to make and meet beyond any question of doubt a pavement which has become a recognized standard under practically all conditions of cost, labor and materials. Such a pavement, when properly laid, has demonstrated itself to be permanent under all varying conditions of traffic.

Concrete pavements meet all of the above requirements, but the concrete pavements of the future must be so put together in their making as to leave no room for doubt to even the most skeptical. It is in this putting together of a concrete to be used for a pavement that the manufacturer of hydrated lime is bound to find an ever increasing demand for his standardized hydrate.

The utilization of concrete as a paving material during the last five or six years has developed into an extremely important business, and is destined to become one of the greatest, if not the greatest consumer of Portland cement. Concrete pavements are found in practically all states in the Union, while the various counties of several states have practically standardized this pavement. Notable among these is the county of Wayne, which includes the city of Detroit, Mich. Since the inception of concrete road building in Wayne county, about five years ago, more than 70 miles of concrete pavement have been laid, and the county long ago adopted concrete as its standard pavement. As this county has placed more concrete pavements, and of necessity has had more actual experience in handling concrete pavements than any other section of the United States, it is interesting and instructive to know what its specifications call for and how experience has taught its officials to do their work.

1. Great care is taken in preparation of the sub-base. Experience has shown that more cracking in concrete pavements has resulted from improper and careless treatment of the sub-base than from any other one cause for cracking; consequently the sub-base is rolled hard and made as uniform as possible; also density is desired so that water seepage from the concrete into the sub-base may be diminished as much as possible.

2. Careful specifications for the sand, gravel or crushed rock and cement are insisted upon and carried out to the letter. Careful proportioning and mixing of the concrete are also done.

3. Within the last four years a gradual increase in the richness and thickness of the concrete has been specified and the present specifications call for a 1:2:3½ concrete mixture 7½ inches thick for a one-piece concrete pavement.

4. Care in protecting and covering all concrete after placing and keeping it covered for at least ten days. This precaution is taken to prevent the loss of moisture by evaporation from the surface of the concrete.

5. The use of steel expansion joints cutting the entire depth of the concrete at each 25-foot section and the filling in between these sections as formed, by pieces of asphalted felt.

Placing and treatment of concrete pavements under the above specifications have produced results which are very satisfactory, and in carefully analyzing these specifications it would seem that every particle of engineering and common sense had been used. In prac-

tically every step in the process of laying the concrete it has been the intention to carry on the work so that future cracking may be eliminated, yet in spite of all these precautions more or less cracking has developed and is generally attributed to settlement of the sub-base or the movement of the concrete, due to temperature changes.

From the writer's experience, gained in the testing of materials which go into concrete, as well as from experience acquired in the supervision of important concrete work and examination of so-called "concrete road failures," he does not believe that the fundamental causes for cracking in concrete pavements are temperature changes in the concrete or settlement of the sub-base alone. There are other primary and extremely important reasons why these so-called temperature and settlement cracks develop at a later date, and until we take proper steps and exercise due care to the right time, we cannot greatly reduce this excess cracking.

No specification for laying concrete pavement, to his knowledge, has taken into consideration the chemical peculiarities shown by Portland cement concrete in its preliminary setting and hardening periods. There has been no special provision for retaining to as large a degree as possible the actual mixing water first used in the concrete mixture. By careful treatment of the sub-base and protection of the finished surface of the concrete after pouring, it is the intent of the various specifications with which the writer is conversant, to retain in the concrete as much of this first mixing water as possible. While these precautions are a great help, they are not quite sufficient, as they rely to a great extent on treatment of surfaces to keep the water from leaving the concrete. The prevention of this leakage of water from concrete after the first few hours in which it is poured is an extremely important feature, and in this connection it is well to bear in mind that the reaction between a solid, such as Portland cement, and a liquid, such as water, is a surface reaction, water being able to react on the surface of the cement grain only, and that owing to the slowness of the reaction and the insufficient amount of water being present, **only a relatively small amount of the Portland cement is at first decomposed by water.** Consequently, if we can actually keep within the concrete mass what little excess mixing water we start with, or introduce into the concrete mass in the mixing some substance that contains or will readily hold excess water which the cement may secure later, we shall accomplish what has not been done before.

There is no more important period in placing a concrete road surface than the first twenty-four hours after pouring the concrete, for it is in this period that minute spots of weakness generally develop, due to the loss of water by leakage and evaporation and use of water by the cement in setting, causing contraction in the first twenty-four hours. Upon the later permanent hardening of the concrete, we do not secure a slab of so great cohesive uniformity as would be expected on first consideration.

The general conditions under which concrete pavements are placed are severe, as the majority of work is usually done in the dry spring and summer months

*Portion of paper presented at meeting National Lime Mfrs. Assn., N. Y. C., Feb. 4-5, 1914.

when temperatures are high, causing excessive evaporation. The concrete is generally poured on an earth or clay sub-base in a thin slab varying between 4 inches and 7 inches in thickness. This condition alone makes it almost impossible to secure uniformity throughout the concrete mass, so that after hardening the concrete road slab is subject to far greater variation, due to the segregation of the coarse aggregate from the mortar, than is found in other forms of concrete work. This, of necessity, causes unevenness throughout the concrete, and the excessive cracking and unraveling so often seen in poorly laid concrete roads is directly due to this fact.

It is the writer's opinion that the primary cause of cracking in concrete pavements is due to the loss or leakage of varying portions of the mixing water from the concrete by seepage through the sub-base, as well as by evaporation from the surface of the concrete, which leaves the concrete road slab in such a condition that at later times it will alternately absorb and give up water, depending on the season of the year, and that expansion and contraction of concrete and any movement in its volume are due infinitely more to this alternate wet and dry condition than to any temperature change from hot to cold without presence of moisture.

That the cracking which is directly attributed to the change in the condition of the sub-base, either in settlement spots or in drying out in shrinking, is primarily due to this cause, which is greatly helped by unevenness and variability of the concrete mixture.

That there are extremely few, if any, concrete pavements, individual slabs of which can be considered entirely uniform.

The Use of Hydrated Lime.

Hydrated lime is a product formed by the addition of accurate quantities of water to known weights of freshly burned quicklime, the finished material being a flour-like powder of great fineness and covering capacity, having more than twice the volume of the same weight of cement in its dry state.

The use of hydrated lime as a void filler in concrete mixtures, and for rendering concrete mixtures more water-tight, dates back several years. Numerous tests show that a replacement of from 10% to 15% of cement by hydrated lime in rich concrete mixtures does not decrease the compressive strength of the concrete after three to four months' time, and ultimately increases the strength and permanence of the concrete. It apparently makes but little difference as to its action as a void filler, whether the hydrate is manufactured from a dolomitic or high magnesia lime or a high calcium lime—it being necessary only to have a product which contains no free lime or unslacked particles. The proper hydration or dry slacking of lime reduces it to a finer degree of subdivision than can be accomplished by any mechanical means.

The amount of water required to convert the dry hydrated lime into a plastic paste varies from 50% to 70% of the weight of the lime; while, to obtain a mortar of similar consistency with Portland cement, an addition of 25% to 30% of water is required.

Unlike Portland cement, however, the addition of water to hydrated lime does not create any chemical reactions. There is simply a lime paste formed which holds its excess water for a long time. Upon the addition of small quantities of hydrated lime amounting to 10% or 15%, to the weight of cement used in concrete mixtures and the ordinary mixing of such mixtures, the hydrate, which has absorbed a large amount of water, corresponding to its weight, is thoroughly disseminated throughout the concrete mass, and, due to its fine plastic conditions, it is forced immediately into places in the concrete which the cement cannot reach.

Concrete, so mixed, on leaving the mixer, flows more readily into place and the coarse aggregate has much less tendency towards segregation in the concrete mass. In other words, the extremely finely divided condition of the moistened hydrated lime paste has increased, to a marked degree, the covering or spreading quality of the cement, and reduced, to a similarly marked degree, the friction between particles of fine and coarse aggregate.

This answers the question "Why does hydrated lime benefit concrete?" The action is purely a mechanical one, and can be compared to the oiling or greasing of a shaft or bearing. The property which hydrated lime has of absorbing and retaining large percentages of water offers a ready solution to the problem of finding a means for keeping and holding moisture in freshly poured concrete pavements until the slower-acting cement-hardening process can utilize it.

It is obvious that small percentages of hydrated lime, when added to concrete mixtures, in road work, will accomplish the following things:

1. Renders the concrete highly plastic and homogeneous, thus producing density and uniformity in the finished concrete. This condition adds much to the life and efficiency of the road because of the uniform resistance to wear and other stresses.
2. Keeps a certain amount of excess moisture in the concrete while setting.
3. Renders the concrete mass more nearly water-tight, thereby preventing the alternate wetting and drying out of the finished concrete.
4. In large pieces of work, these properties given to concrete by hydrated lime would materially reduce the labor in spreading and bringing the concrete to a uniform surface, which is of great importance in paving work.

ESSAY ON FIREPROOF CONSTRUCTION WITH CONCRETE WINS ADVERTISING PRIZE.

J. P. Beck, publicity manager of the Universal Portland Cement Company, was awarded the \$1,000.00 first prize for the best constructive and suggestive essay on advertising by the Awards Committee of the Associated Advertising Clubs of America at the Toronto convention.

Mr. Beck's essay covered a hypothetical campaign for fireproof construction with concrete and dealt with the tremendous annual fire loss and annual fire tax, and the relief offered from that loss and taxation by safer and saner construction with concrete.

Mr. Beck's familiarity with the various phases of the cement industry and his careful investigation of fireproof construction formed an excellent basis for his effort. This knowledge, combined with his wide experience with common-sense advertising led the judges, Professor Paul T. Cherington of Harvard University, John Renfrew, Los Angeles, Cal., and A. G. Newmyer, New Orleans, La., to pronounce his essay the best of the thousands submitted.

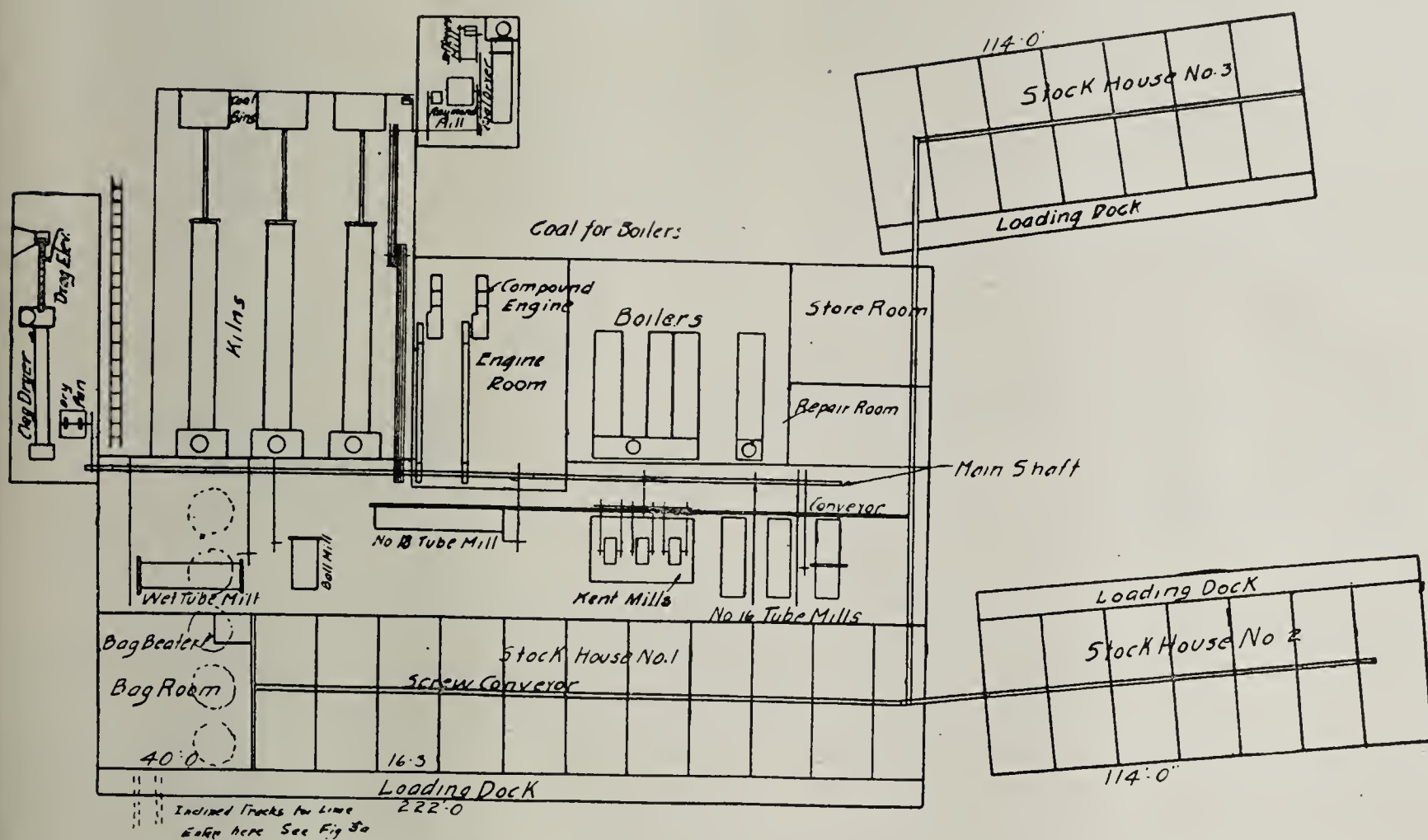
Mr. Beck has been associated with the Universal Portland Cement Company as publicity manager for a number of years. He is widely known in the cement industry as general manager of the Cement Products Exhibition Company, under whose auspices the annual cement shows are held. Mr. Beck was elected secretary and treasurer of the first National Conference on Concrete Road Building, which was held at the Auditorium Hotel last February. He has been closely in touch with all the great movements of the cement industry and possibly no man in the country is better qualified than he to write on the subject he chose.

The Plant of the Wyandotte Portland Cement Company.

While natural limestone and clay are generally the raw materials used in the manufacture of Portland cement, yet in some cases a waste or by-product of another industry can be used to very good purpose. Notable examples of such a use are the plants of the Universal Portland Cement Company, a subsidiary of the U. S. Steel Corporation, which uses blast-furnace slag, composed essentially of lime, silica and alumina, and also that of the Wyandotte Portland Cement

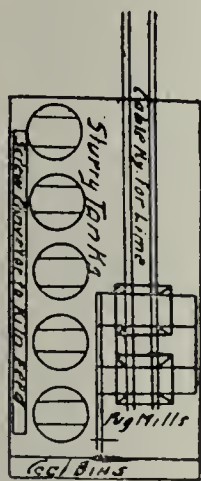
cated the great salt beds of southeastern Michigan. The raw materials of alkali manufacture are salt and oxide and carbonic acid. The salt and carbonic acid are used to form sodium carbonate, or soda-ash, as it is called. The sodium carbonate and lime are combined to produce caustic soda and calcium carbonate.

This lime carbonate is a precipitate from the above reaction, and is in the shape of a finely divided powder, passing through a 200-mesh sieve.



GENERAL LAYOUT OF THE CEMENT

At the left is shown the arrangement of tanks and trestle, really on the second story of the mill



Company at Wyandotte, Mich., which, associated with limestone. The limestone is burnt to produce calcium the Michigan Alkali Company, uses the pure powdered calcium carbonate, a waste product of the Alkali Company, and a natural clay brought from pits near Toledo.

Of interest here is the chemical reaction involved in the manufacture of the caustic soda which produces great quantities of this calcium carbonate as a by-product. Underlying the plant, which is situated on the Detroit river, just southwest of Detroit, are lo-

The cement plant is situated adjacent to the alkali works, so that the lime is brought directly from the filters to the mixing mills in the cement plant in bottom-dump cars, holding about 3 cu. yds. These cars are operated on a double track incline trestle by a cable, like a double elevator; one goes up, while the other goes down. The lime is dumped into hoppers above the mixing pug-mills.

At this point the clay is added, by putting into the hopper above each pug-mill a weighed quantity for every car of lime. The lime carbonate is treated as a constant and any variation in the mix is taken care of by changing the quantity of clay added. The lime carbonate and clay are thoroughly mixed in two double-shaft pug-mills. The clay is received by rail from pits at Milbury, O. It is unloaded from cars by hand over an apron and into the boot of a drag elevator. The elevator feeds it into a dryer, and from the dryer the clay goes into a dry-pan, which produces a finely powdered dry clay ready for the screw conveyors and elevators to carry it to the clay bins, adjacent to the mixer hoppers.

From the mixing mills the slurry goes down to a wet tube mill, built by F. L. Smidth & Co., New York, N. Y., and is ground to a fineness of 98 per cent through a 200-mesh sieve. From these tube mills the slurry is pumped into five steel slurry tanks 12 ft. in diameter and 12 feet high. A Bonnot double plunger pump is used, made by the Bonnot Company, Canton, O., and an ingenious rig is used for sampling the slurry as it is pumped into the tanks. Where the 6-in. riser pipe comes up from the pump and feeds into the lateral for each tank, it is tapped with a $\frac{1}{2}$ -inch pipe leading off. This $\frac{1}{2}$ -inch line opens downward, feeding into the periphery of a revolving funnel about 24 inches in diameter. At one point on the edge of the funnel a slot or pocket is fixed which opens out so that the slurry intercepted by the slot is discharged outside the funnel into a sample box. The inverted cone, or funnel, revolves at about 1 r. p. m. and, as it takes about 1 hr. to fill a tank, 60 samples are taken in that time. A greater number of samples could easily be secured by speeding up the cone sampler.

In the tanks, the slurry is continually agitated by large blades, resembling more than anything those in a great ice cream freezer. The blades are so set, inclined very slightly from the horizontal, that the mass

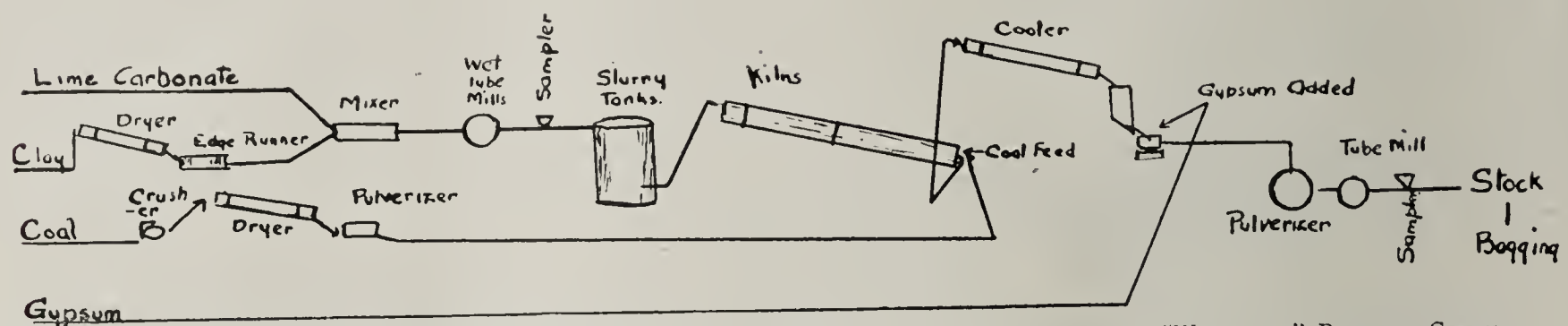
in the kilns, so that the steel clinker bins into which the clinker enters are approximately above the feed ends of the kilns.

The clinker is taken from the bins at the foot of the coolers in hand-pushed bottom-dump cars. A track scale is located at each bin, and a definite amount of clinker from each bin is placed in the car. It is interesting to watch the operator put his foot on the scale platform, and watch the beam. He shuts the bin gate, and so estimates the pressure applied with his foot that it approximates the weight of the stream of clinker which has passed the bin gate, but which has not reached the car when the gate was shut.

At this point the gypsum is added by dumping a definite quantity by hand on top of the car of clinker.

At this step in the process, the clinker is at an elevation above the main level of the plant, and the dump car is pushed along a track to a position above either ball mills or Kent mills, and dumped directly into hoppers above the mills. Here the preliminary grinding is done and the cement is conveyed to the bins above the Bonnot tube mill, where it is reduced to the finished cement.

A spiral conveyor runs along under the roof of this building, carrying the cement to the stockhouse. A re-



DIAGRAMMATIC SKETCH SHOWING THE PROCESS OF THE MATERIALS IN THE MANUFACTURE OF "WYANDOTTE" PORTLAND CEMENT

Tube Mills in this Plant Furnished by F. L. Smidth & Co., New York City; Kilns and Plunger Pump by Bonnot Co., Canton, Ohio; Coal Pulverizer by Jeffrey Mfg. Co., Columbus, Ohio.

of slurry, instead of being carried round and round as it would be in case the blades were inclined more vertically, is carried in an axial motion upward.

From the tanks the slurry is fed along a trough to feed tanks located directly behind the kilns. The kiln feed is a very ingenious arrangement by which a small wheel, about 24 inches in diameter is fitted with buckets, and, revolving in a filled boot, discharges a uniform feed into the head of the kiln. There are three kilns, made by the Bonnot Company, Canton, O., 6 ft. x 100 ft.

The coal after being slacked, is carried directly to a Raymond mill, made by Raymond Bros. Impact Pulverizer Company, Chicago, where it is pulverized to the required fineness. The Raymond air-separation system is used. To handle what lump coal is received, a Jeffrey crusher is installed to crush the coal before going to the dryer.

The coal is introduced into the kiln under low air pressure and is fed along to the air lines by spiral conveyors, the speed of which can be controlled at each kiln by a double cone pulley.

The clinker produced at this mill is uniformly dark in color, and is exceptionally fine, averaging on the whole about the size of navy beans. Much of it is small and round, like little dark peas. From the discharge end of the three kilns, the clinker falls into a central pit or boot, and from there is elevated by bucket elevator to the two coolers, located approximately directly above the kilns. In the coolers the clinker travels in a direction reverse from what it does

volving sampler, similar to the one used for the slurry, is used here also, being fed from a steady stream issuing from a hole drilled in the bottom of the conveyor. Tests on the finished cement are made every hour.

Bags are cleaned in a revolving drum very much like a carpet beater. Blocks of wood are placed in the drum with the sacks, so that they are thoroughly beaten, and the dust knocked out of them.

The cement is bagged by hand, using big, long and comparatively narrow scoop shovels, and a rack to keep the mouth of the sack open. Men are paid by piece work, and average very good wages. The operation is much simpler and faster than seems possible. A sack is picked from a pile, placed in the rack, which holds the edges back so that the mouth is open, and the bag is lying in an inclined position with its mouth about 12 ins. from the floor. This is the first operation.

Three or four shovels full of cement are put into the sack, and the man swings it into the scale. The baggers are able to estimate accurately the amount required, and a handful scooped out or put in brings the sack to the correct weight. Twine is used to tie the sack, and it is stacked on a truck and wheeled into the car or stock pile. The "Universal" Bag truck made by the Universal Machine Co., Bowling Green, O., is used exclusively in this plant.

The entire power for the plant is supplied by two compound engines. The first one of these, installed in 1898, was built by the McIntosh, Seymour Co., Auburn, N. Y., and develops 450 h. p. The second is a

Cooper-Corliss engine, built at Mt. Vernon, O., by the C. & G. Cooper Co. Canvas belting is used throughout, and is giving good service.

A two-story concrete block building is located at the plant, which is fully equipped for physical and chemical analyses. A new Riehle automatic briquette testing machine is installed. An ingenious evaporating or drying oven is made by a small box, below which are placed about eight incandescent lamps. This oven can be closed tightly, and a temperature of 300° F. is readily secured.

The executive force at the plant consists of S. P. Cole, supt., and the writer as chemist. The executive and sales offices are located in Detroit; H. J. Paxton, sec. and sales mgr. and D. P. Sullivan, pur. agt.

[This article was written for Concrete-Cement Age by F. J. Beal, Chemist of the Wyandotte Portland Cement Co.]

SAFETY RULES FOR STEAM SHOVELS

The following rules were recently reprinted by the Coal Age from the Inland Steel Co.'s book of safety regulations; they may offer some good suggestions to our readers.

A proper signal should be given before a steam shovel is moved on its track.

Steam shovel engineers should make a daily inspection of the machine under their charge and of all the cables and chains on their shovels, and report defects immediately to the master mechanic.

See that ladders, footboards, hand holds, running boards and steps are kept in constant repair and free from cans, grease, snow and ice.

No person whose duty does not require it should be permitted on steam shovels.

No gasoline should be kept inside of a steam shovel.

No person should be allowed near any car being loaded at a pocket or by a steam shovel. Warning is given that chunks of material frequently roll over the side of cars being loaded and it is an extremely dangerous practice to be around or near the same at such times.

Banks alongside steam shovels should be trimmed down of all loose material. Bank trimmers should notify men working below them. Men should not stand behind the shovel.

Proper care should be taken to prevent trestle legs from falling and injuring workmen.

Keep away from in front of the shovel to avoid being crushed between dipper and track; do not attempt to pass under the dipper.

Chain or block steam shovel and cars when set on grade and apply the car brakes.

Short whistle blasts on steam shovels and locomotives should signify, "Look Out for Blast." Two long whistles should signify that blasting is over and work may be resumed.

Care should be taken to keep black powder well covered when charging holes in open pits and to leave none scattered around the holes. Sparks from locomotives or steam shovels may cause an explosion.

Men dumping stripping cars should step back as soon as toggle-chains are knocked off and cars dumped.

Shovels under steam should not be left without a competent man in charge.

STRIKE CALLED OFF

Announcement is made that the strike at the plant of the Westinghouse Electric & Manufacturing Company at East Pittsburg, has been called off by the workmen on Thursday, July 9th. The works are now running full time.

CONCRETE FOR OIL RESERVOIRS.

Considerable experience has now been had in the Southwest in the use of concrete for oil reservoirs and other purposes where the asphaltic oils of that section of the country remain more or less continuously in contact with concrete. The railroad companies are large users of oil; and among these the Atchison, Topeka & Santa Fe Railway Company is a leader in such practice. Through the courtesy of Mr. R. J. Arey, engineer of the Coast Lines of that company, with offices at Los Angeles, Cal., the following notes regarding the experience on the grand division of which he is the engineering head are here published:

On the Albuquerque Division, the division engineer, Mr. E. E. Ball, reported that concrete-lined reservoirs had not been affected by oil. Some slight effect had been noticed on the concrete floors and foundations of boiler shops and pump houses, where the dripping of oil on the concrete apparently caused it to disintegrate somewhat. This might be due, it was said, to the action of the oil, or it might be due to the fact that the concrete was placed during cold weather and was frosted during setting.

On the San Joaquin Valley Division, Mr. William L. Bradley, division engineer, called particular attention to an experience with a reservoir at Rheem, near San Pablo, belonging to the Standard Oil Company, which was burned in the early part of 1910. This reservoir had a concrete lining on the sides and bottom. The lining was laid off in slabs about 3 feet wide, with a joint extending from the surface several inches into its body. These joints were intended to offset the cracking by shrinkage, and apparently answered the purpose well. During the fire the oil burned down so that when it was extinguished and the basin was visited by Mr. Bradley there was only about 2 or 3 feet depth of oil and water in it. This left practically all of the sides exposed, and an examination of them showed that possibly some of the joints had been opened wider than otherwise by the action of the fire; but there were only a very few small irregular shrinkage cracks elsewhere in the joints, the concrete being in excellent condition. Although Mr. Bradley reported that the concrete lining was in good condition, it is understood that the Standard Oil Company has discontinued the use of concrete for lining its reservoirs in that section of the country, for the reason that it believes the oil gradually enters the concrete and disintegrates it, and that this is particularly noticeable in the case of reservoirs or basins holding distillate, which apparently injures the concrete far more rapidly than oil.

So far as the experience of the Valley Division itself is concerned, several concrete linings have been used for oil reservoirs and sumps, and no special effect of the oil has been observed.

A number of tests have been made on the Arizona Division of the railroad under the direction of Mr. W. H. Oliver, division engineer. Concrete-lined oil sumps are there used, and the penetration of the oil into the concrete has been practically nil, no noticeable detrimental effect of the oil having been discovered. At one place the depth of penetration of the oil into the concrete was only about the thickness of a sheet of ordinary letter paper.

At the pumping stations of the Arizona Division, concrete service storage reservoirs for fuel oil have been used. Although the oil is at a comparatively high temperature on this division, the concrete in the sumps has not shown any sign of deterioration. While the quantity stored in any sump is small, the penetration of the liquid into the concrete would be just as rapid as in a much larger basin in all probability.—[Engineering Record.]

MEDUSA WATERPROOFING.

The Sandusky Portland Cement Company, Sandusky, Ohio, is also a manufacturer of Medusa Waterproofing, a dry white powder consisting of fatty acids chemically combined with white lime, which is mixed dry with dry cement before sand and water are added, thus becoming an inseparable part of the concrete. Owing to the extreme fineness it may easily be perfectly mixed with cement in the necessary proportions.

Medusa Waterproofing does not affect the color, strength, setting or hardening qualities of concrete, and when used in proper proportions it will make any concrete work impervious to water and prevent discoloration from rain. It also prevents the white efflorescence which so often renders cement work un-

some of the wonderful results obtained with Medusa will be sent to those interested.

Gray and white waterproofed Portland cements are also manufactured by the Sandusky Portland Cement Company and consist of Medusa waterproofing ground with Portland cement in the process of manufacture and is a most valuable addition to the list of high-class building materials. This company is the exclusive manufacturer of both cement and waterproofing, and as the demand for this new product has far exceeded expectations, it has been found necessary to install extra grinding machinery and packing apparatus to enable them to fill orders promptly.

CONCRETE SILOS.

The Weyerhaeuser State Bank of Weyerhaeuser, Wis., is loaning money to farmers to erect concrete



New York City Post Office.

Built of Granite Laid in Medusa White Portland Cement Exclusively. Medusa Also Used for Facing Exterior of Walls of Court Yards. 6,000 Barrels Required. Declared to Be the Finest Building of its Kind Erected in New York This Year. McKim, Mead & White, Architects. George A. Fuller Company, Contractors.

sightly, and prevents the appearance of hair cracks on the surface.

Medusa Waterproofing is specified by the most eminent architects and engineers in the United States and Europe, and is rapidly displacing the old-time paints and coatings formerly used to prevent the penetration of water into concrete.

It will be found to be especially useful in making building blocks, cement plaster, roofing tile, cellar walls, cistern and reservoir linings, conduits, sewer pipe, elevator pits, and in a multitude of other uses in which resistance to percolation of water is required.

One hundred thousand pounds was used in the New York Dock Company job, Atlantic Basin, Brooklyn, while the United States Government has used Medusa in work at Puget Sound Navy Yard, Fort Monroe, Va., and other points.

Samples and free illustrated booklets describing

silos. Last year five farmers were extended credit for this purpose. This year the bank expects to serve several times as many.

You could hardly expect to get a loan from a bank for building silos which fire could burn and which wind could blow down. The risk is too great. Your banker, however, knows that a concrete silo is built to last. It is a permanent investment. If you have not the ready money necessary to build a silo, it is good finance to borrow the money. The saving in feed in a single year, or at the outside, two years, would repay the loan.

The general introduction of the silo to the farm life of the United States has added tremendously to the actual wealth of the country and is undoubtedly the greatest enterprise that has ever been inaugurated. It turns material otherwise waste into profits and adds vastly to the profits from the roughage.

THE FOLLY OF USING "BANK-RUN" MIXTURES IN CONCRETE

To obtain good concrete, accurate proportions are necessary. If correct proportions are not specified, or if the specified proportions are not observed, high quality cannot be obtained. When a 1:2:4 mixture is specified, there is no excuse for allowing a 1:6 mixture of cement and "bank-run" aggregate. Such a statement seems entirely unnecessary and yet the rule is being daily disobeyed.

If the gravel pit is close at hand, a peculiar mental inertia seems to overcome the contractor in consequence of which the cement is mixed with the bank-run material, without separating the sand and gravel and remixing in the correct proportions. This is bad practice, since in practically every bank the sand is generally twice the volume of the coarse material. But to make matters worse, if a 1:2:4 mixture has been specified, the contractor thinks he will meet the specifications by using

Uniformity is impossible when bank-run gravel is used. There are many engineers who will question this statement, on the ground that it is always their practice to screen out a small sample, from which the amount of coarse material to be added is determined. The folly of this method of proportioning can be proved by screening samples from various parts of the same pit, which will show variations all the way from plastering sand alone to coarse gravel with no fine content whatever. No two wagon loads coming from the same pit will have the same proportions of sand to gravel—a strong argument for separation and remixing.

Good concrete, then, requires accurate proportioning of aggregate as well as accurate measurement of cement. To secure it two points should be strongly impressed on all who write specifications or are entrusted with their enforcement: First, that the proportions must be correctly stated and adhered to; second, that accurate measuring of the separated aggregates must be insisted upon. —Engineering Record.



Los Angeles, California, Residence.

Medusa White Portland Cement Used for Exterior Finish.

Frank Tyler, Architect.

H. H. Belden, Builder.

one part of cement and six parts of bank-run. Thus, instead of approximately one-quarter of a cubic foot of cement per cubic foot of concrete, only one-sixth of a cubic foot is obtained.

The idea then occurs that rather than take the trouble to separate the fine and the coarse materials, good concrete can be obtained by using one part of cement and four parts of the bank-run, but in most gravel banks the sand is about double the quantity of the coarse gravel instead of the reverse, which is to be desired. Thus, not only is less cement used per cubic foot of concrete, but the strength is decreased by the excess of sand. A report of analyses on samples of cement and bank-run, mixed in proportion of one part of cement to four parts of the mixed sand and gravel, indicates that the mixture runs about 1:2¾:1¾, giving a weaker mortar and a smaller yield than the 1:2:4 combination. It would be cheaper, and better concrete could be obtained, if the amount of coarse material was increased and the fine decreased. Accurate proportions can only be brought about by the use of separate materials, of known size and gradation. The contractor will be repaid for the expense of screening by the greater yield per barrel of cement and the owner will secure a better, more uniform concrete.

SAND AND GRAVEL RATES

Relief from hardships imposed by the Cashman distance tariff law on industries in suburban districts of Minnesota cities came today in an order issued by the State Railroad and Warehouse Commission.

The case which brought out the order was the complaint of the Washed Sand & Gravel Company of Minneapolis against the imposition of the distance schedules for a five-mile haul on its products from the company's plant, 700 feet outside the city limits on the Great Northern tracks, to points within the city. The charge under the Cashman rates was \$6.40 for a car of 40,000 pounds, while competitors just within the corporate limits have a switching rate on other lines of \$4.00 a car.

Prior to January 1, when the law became effective, the carriers charged a switching rate only for moving business between St. Paul, Minneapolis and the Minnesota Transfer, between Minneapolis and Hopkins, and between St. Paul and North St. Paul and South St. Paul. On the theory that the law forbade the continuance of such a set rate the companies canceled them and applied rates fixed in the commission's schedule for all traffic between these points.—[St. Paul News].

SAFETY IN QUARRY WORK

It is a hopeful sign of the times that the slogan, "Safety first," has found such general adoption. It is only one indication of the greater value we have learned to set on human life. It is pleasant, too, to remember that this movement had its origin among the employers of labor before the enactment of the various workmen's compensation laws. Some of the statutes that have been adopted are extremely drastic, however, and it will be necessary to make the most careful study of safety devices and preventive measures in every line of industry. Apart from all questions of humanity, this course will be commended as an economic advantage.

The quarrying industry has long been classed among the hazardous occupations. This is due somewhat to a tradition of the past, when human life was held for cheaper than the present, and before the perfecting of modern machinery and methods of stone extraction. The best figures that are now available, however, show that quarrying is far less dangerous than many other lines of activity. The Bureau of Mines, of the Department of the Interior, has just issued a body of statistics, compiled by Albert H. Fay, showing the quarry accidents in the United States during the calendar year 1912. This is the second annual report of the kind, and it is full of interest and suggestion for every one engaged in the production of stone. There is no question that a careful study of such statistics as these is bound to be made and will eventually result in greater safety for all quarrymen.

Before considering the report in any detail, it may be well to discuss the method of classification that is followed. Perhaps it is only natural that the accidents should be put under the following general groupings: Cement rock, granite, limestone, marble, sandstone and bluestone, slate and traprock. If the statistics are gathered in connection with the figures showing the annual output of the different kinds of stones, it may be more convenient to preserve the same classification. But it must be apparent to any one having any technical knowledge of the subject that the method of quarrying adopted is dependent more largely upon the use to which stone is put and its formation than upon its mineral and chemical composition. In the matter of limestone, for instance, the oolitic variety is extracted by channeling machines, like marble, while limestone for flux or road building purposes is blown out by huge blasts, hundreds of thousands of tons sometimes going down as the result of a single explosion. It is manifest, therefore, that we shall have little help in putting our hand upon the real danger points in limestone quarrying if we have merely the record of accidents in the entire industry without any hint as to the method that is followed. It would be a great gain if the first rough classification could be into dimension stone quarrying and rock or crushed stone quarries. Then desirable subdivisions would be into quarries that remove stone mainly by machinery and those that extract it chiefly by explosives. Perhaps this would present too great a difficulty, but as we study the figures already compiled and published it will be found that they fit at such a classification as we have suggested. In other words, the great cause of fatality was explosives, which finds scant use in dimension stone quarries.

According to the figures given by Mr. Fay, the number of men killed in and about the quarries in the United States during 1912 was 213. Compared with the fatalities reported for 1911, which totaled 188, there was an increase of 25, or 13 per cent. The number of men employed in the quarry industry during 1912 was 113,105, as compared with 110,954 in 1911, approximately 2 per cent more. The fatality rate for 1912 was 1.88 per 1,000 men employed, as compared with 1.69 during 1911, an increase of 11 per cent.

In France for the 5-year period, 1906 to 1910, inclusive, the fatality rate from quarry accidents was 1.08, and in Great Britain for the 10 years, 1903 to 1912, inclusive, the rate was 1.04 per 1,000 men employed. The higher fatality rate in the quarries of the United States probably result from less stringent regulation and less systematic inspection, says Mr. Fay. Nearly all quarries are open to the sky, so that the workers have ample light and air and are not exposed to the risk of roof falls; hence the fatality rate should be lower than in underground mining for coal or metals. During 1912 in the coal mines of the United States the number of men killed was 3.27 per 1,000 men employed, and in the metal mine 3.91 per 1,000 employed.

Mr. Fay calls attention to the fact that, although quarry work is performed in the open, yet falls of rock or overburden caused 23.94 per cent. of the fatalities reported for 1912. We may doubt if there were many accidents of this kind in the dimension stone quarries. It is a form of fatality confined very largely to slate and rock quarries. The principal hazards of quarrying appear to be about equally divided as follows: Falls of quarry material, explosives and haulage; these three represent slightly over two-thirds of all fatalities. The handling and transportation of the material produced in the quarry ranks third.

The figures for granite quarries are compiled from reports of 502 operators employing 18,935 men, of whom 12,090 were employed in the quarry and 6,845 outside of the quarry. The total number of deaths and injuries due to accidents reported is as follows: Deaths, 29, or 1.53 for 1,000 men employed; serious injuries, 127, or 6.71 per 1,000; and slight injuries, 570, or 30.10 per 1,000.

The figures for sandstone quarries are compiled from reports of 462 operators employing 9,753 men, of whom 7,240 were employed in the quarry and 2,513 outside of the quarry. The total number of deaths and injuries due to accidents reported is as follows: Deaths, 8, or 0.82 per 1,000 men employed; serious injuries, 61, or 6.25 per 1,000, and slight injuries, 251, or 25.74 per 1,000.

The figures for limestone quarries are compiled from the reports of 1,760 operators employing 56,376 men, of whom 40,790 were employed in the quarries and 15,397 outside of the quarry. The total number of deaths and injuries due to accidents reported is as follows: Deaths, 101, or 1.79 per 1,000 men employed; serious injuries, 463, or 8.21 per 1,000; and slight injuries, 3,234, or 57.35 per 1,000.

There were 63 marble quarries reporting, with 4,566 men employed during 1912, of whom 2,963 were in the quarries and 1,603 outside the quarries. There were 12 men killed, or 2.63 per 1,000 men employed. The seriously injured were 44, or 9.64 per 1,000, and the slightly injured 161, or 35.26 per 1,000.

In the slate quarries there were 152 in active operation, with a total of 7,827 men employed, of whom 4,073 were in the quarries and 3,754 outside the quarries. The casualties were: Killed, 18, or 2.30 per 1,000 employed; seriously injured, 28, or 3.58 per 1,000; slightly injured, 75, or 9.58 per 1,000.

There were 138 traprock quarries reporting, with 6,186 men employed, of whom 4,833 were in the quarries and 1,353 outside the quarries. There were 15 deaths, or 2.42 per 1,000 employed; seriously injured, 57, or 9.21 per 1,000; and slightly injured, 278, or 44.94 per 1,000 employed.

The cement-rock quarries are represented by 86 operators, who employed 9,462 men during 1912. The number of deaths and injuries due to accidents reported is as follows: Deaths 30, or 3.17 per 1,000 men employed; serious injuries, 119, or 12.58 per 1,000; and slight injuries, 1,084, or 114.56 per 1,000. Mr. Fay

says that the high ratio of injuries in the cement-rock quarries, as compared with other quarries, is probably due to many cement quarries being operated on a large scale by large corporations that keep better records of serious and slight injuries and render more detailed reports. Many small quarries keep no record of serious and slight injuries, hence the seemingly low ratio of non-fatal accidents in quarries other than cement-rock and limestone.

We venture to take exception to this conclusion drawn by Mr. Fay. We are confident that the larger percentage of fatalities and injuries is due, not to more complete reports, but to the fact that the methods of quarrying where stone must be blasted out and broken up at the cheapest rate are very much more hazardous than when blocks and dimension stones are extracted by machinery. To illustrate this point: The ratio of deaths per 1,000 in the sandstone quarries is only 0.82, while in granite it is 1.53 and in limestone 1.79. It is unquestionably a fact that if the quarries that produce limestone and granite rock and crushed stone were eliminated from this list, the casualties would be no higher than in the sandstone industry. Further comment on these instructive figures must be deferred to a later issue.—[Stone, New York.]

MODERN GRAVEL PLANT EQUIPMENT.

The business of washing sand and gravel is comparatively new, but the strides made in this line of industry have not been equaled by any other stone industry. The Raymond W. Dull Company, 1912 and 1914 Conway Building, Chicago, have placed on the market machinery unusually well designed for this hard service. This company has had considerable experience in handling this kind of material, and has introduced the conical washing screen, which has the quick-change method of attaching the perforated cone to the end casting, by means of large hoob-bolts, which pull the perforated metal inside of the flange of the casting.

This change can be made in less than an hour. The bearings and chain drive are out away from the grit and flushing water.

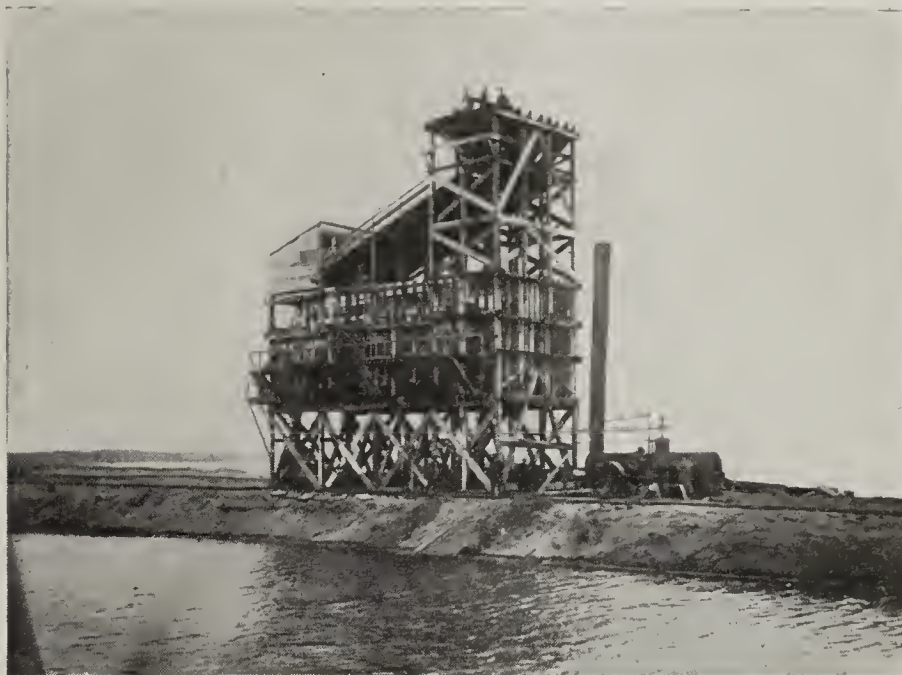
Their catalog shows how these screens are constructed. The castings are forced on the shaft by hydraulic pressure and every part is made extra strong for hard usage. This type of washing screen is said to cost less for repairs than any other make of screen. Its low first cost also has contributed greatly to its popularity.

The arrangement of the conical screens is also shown in their latest catalog. The belt or elevator delivers the material to the stone box, where water is added and washed down into the farthest end of the first screen, which usually has $1\frac{1}{4}$ -inch round perforations. All materials over $1\frac{1}{4}$ -inch is discharged over into the first bin, and if the stone is too large, the oversize is delivered to a crusher. The washing process now begins, as the revolving motion of the screens break the clay and foreign matter away from the gravel.

The gravel is next separated from the mass by the second screen in the same manner as the first. The second screen usually has $\frac{3}{4}$ -inch perforations, and the material in the second bin is everything between $1\frac{1}{4}$ inch and $\frac{3}{4}$ inch. Roofing gravel is obtained by the third screen, and is the material coming through the $\frac{3}{4}$ -inch perforations and over the $\frac{3}{8}$ -inch perforations.

Pipe nozzles are placed at the discharge ends of screens to prevent material from discharging too rapidly, and carrying over some of the finer materials. This fresh water is a rinsing water also and keeps the material from piling up in the box beneath the screens.

The sand, water, soils and impurities are discharged from the last screen into the settling box. The sand settles to the bottom of the tank, and the water carrying the impurities passes over the opening at the top of the tank, and is carried away by a launder. When a sufficient quantity of sand accumulates in the box to weigh a certain amount, the scales on which the box is mounted, raises a lever which allows the sand to go



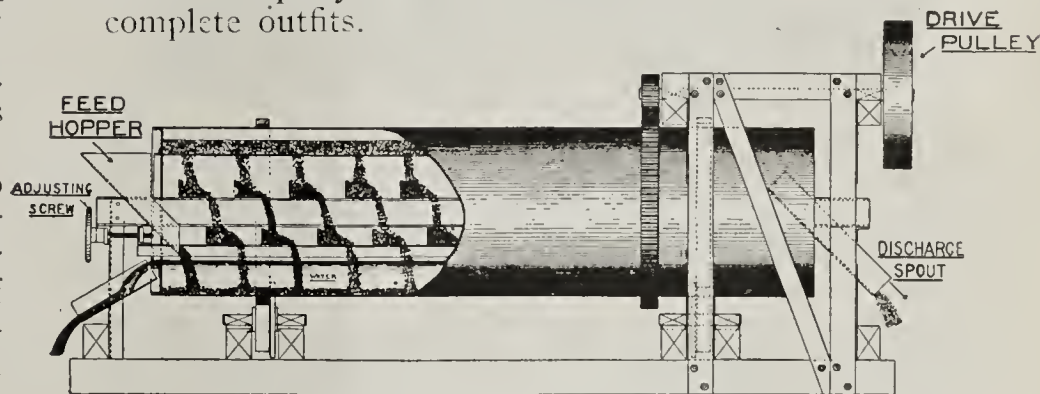
Kamkeska Material Co.'s Gravel Plant, Watertown, S. D.,
Designed by R. W. Dull Co.

into a bin below. Accurate adjustment can be made to discharge sand at any height in the box.

There are various ways of handling the material for the screens, such as bucket elevators, skips, cars and belt conveyors. The belt conveyor is used almost universally where conditions permit, and nothing has proven so satisfactory for this work.

This company furnishes belt conveyors equipped with steel idler pulley, which users say will outwear two of the ordinary cast iron pulleys. These pulleys are also split, and have the double advantage of quick assembling and long wear.

The Raymond W. Dull Company state they equipped more gravel plants during 1913 than any other company. Write for detailed information of complete outfits.



Dull Improved Tubular Gravel Washer.

CONCRETE BRICKS

The Golden State Concrete Products Company has been incorporated for the purpose of manufacturing and marketing concrete brick and tile. The company has offices in the Rialto building and will establish a factory in San Francisco. The Government has indorsed the brick and is using them now at Fort Bayard, N. M., and in Honolulu. It is expected they will be used in local government work as soon as the demand can be supplied. It is claimed this brick costs from 20 to 50 per cent less than clay brick and can be set more rapidly than the common clay brick. A limited amount of stock will be placed on the market and detailed information may be had by addressing the general manager, W. M. Pinney, 404 Rialto building, San Francisco.

The Building of Concrete Culverts.

By Edward J. Whalen.

Going back to the beginning of civilization, our forefathers were in contact with a situation which if compared with our Highway Development of today, will show a remarkable contrast.

Primarily there were no roads. They were compelled to make these as they went, temporarily of the materials such as were available and little attention was turned to their permanent nature. Their chief object was to go beyond or farther onward, a precept of progress which has had its bearing upon the permanent structures of today by virtue of the fact that those who followed step by step made developments, each generation of a more permanent nature until we are today living in the Concrete Age which has superseded all others, justly by reason of its making one of many.



This is a 24 foot Culvert—24 inches wide and 27 inches high—Side-walls and bottom are approximately 12 inches thick—Top covering 4 inches in the form of an arch which has as much strength as 12 or 16 inches would have in the form of a flat. The flat would be objectionable because it would raise the surface of the road or decrease the size of opening. In any event it would require more material. Head-wall is 48 inches square.—Note the Wing-walls and the general pretty lines. This type has been very much adopted throughout N. Y. State.

The present adopted plan is the result of an evolution of various methods employed and time-tested in the construction of Highway Sluices. The temporary wooden sluice or culvert readily gave way to the old style stone culvert with its side-walls of masonry and its top a flat capstone; these in turn, as a mark of progress to the concrete monolithic type which from every angle has been determined by every test to be far superior. Being inert in its nature, composed of one heterogeneous mass, it is not subject to the climatic or elementary conditions frequently evidenced by disintegration or erosion which is so destructive to the ordinary disappointing type of culvert, composed of various light, small sections or parts which invariably gave way and had to be replaced again and again, resulting in the injudicious expenditure of a vast sum of money.

Much credit should be given the Highway Department of New York State for being the first to put the ban on all this irregular and unsatisfactory type of work and enforcing through their Highway Law, the use of state aid for nothing other than permanent work. This very commendable feature should be adopted by every state in the union. The beauty of this plan is easily evidenced by the thousands of uniform concrete culverts built throughout New York State in the past few years.

Next to one of the greatest engineering feats accomplished in the western hemisphere is the Barge Canal from Albany to Buffalo. All its locks, wharfs, retainer-walls and many of its bridges are of solid monolithic concrete. The Panama Canal which takes first place as a masterpiece of engineering has used concrete construction completely throughout its course. The subways of New York City, the Aqueduct carrying the water from the Catskills to the Metropolis, the new Treasury Vaults at Washington and the great Dry-Docks of the Navy Yard, in fact everything pertaining to permanent structures is of concrete.

Taking these well established facts as the basis of a modern method, universally adopted throughout the east resulted in the construction of a Collapsible Steel Form which is of sufficient strength and yet not too heavy to handle and so constructed as to adapt itself to the building of the various sized concrete culverts from a 12 inch height to a 60 inch span, without the prohibitive expense of having to purchase some 15 or 20 different Forms with which to get the different sized culverts.

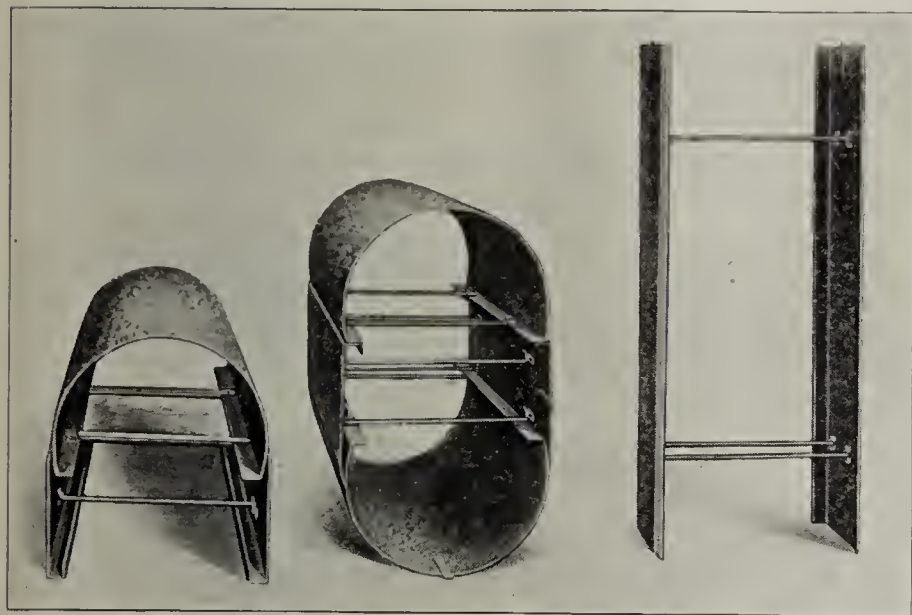
Very exhaustive tests resulted in the creation of the Style "A" Special Collapsible Steel Culvert Form described in this article. This Form in a few minutes time can readily be set in an excavation made across the road-way and used as the water-tight mould to build the culverts as illustrated in this article and which cannot be accomplished in any other way. This mould is easily collapsed and removed to the next "Job" as soon as the cement has taken its initial set, sufficient to support itself in this arched or semi-arched form of construction. This of course, is impossible with a wooden Form as they are usually flat topped and the concrete would not have the self-supporting feature contained in an arch, it usually being necessary to leave the wooden Form in the culvert for several days or in fact in a great many cases it is never removed, as the wood absorbs the moisture from the concrete and swells to such an extent that it is not at all an infrequent occurrence for the culvert to be cracked from one end to the other by the expanding force. In any event, where nice work was desired, the wood used in the Form could not be used the second time as it became curled and cracked from being wet on one side and dry on the other, resulting in the necessary expense of purchasing new lumber for each Form which is a very unnecessary extravagance.

The Steel Collapsible Culvert Form, notwithstanding its great convenience, has every economic advantage.

It is a well established fact that any given quantity of cement contains only a certain percentage of an active agency. This active agency to be of any value in uniting or bonding the molecules which form the mass, must be in solution, that is, be soluble in water.

As an illustration, we will use as a hypothesis a

sluice containing 12 cubic yards of material: 8 yards of heavy field, fence or old sluice stone, 3 yards of fine crushed stone, sand or gravel and 1 yard of cement, composing the 12 yards aggregate. Assuming that the 4 yards of fine material was the required amount to take up the voids in the heavier material, a ratio of mixture of 3 to 1 then would exist between the fine material and the cement. It is quite safe to say that the active agency contained in any given quantity of bulk cement is quite small, the greater portion being



This is detail of the Form which shows one of the many uses. You can build an oblong—round bottom and round top—or you can lay flat and build a sewer. 36 inches wide and 34 inches high. You can build hundreds of different styles and types of Culverts and sewers with this one Form.

base. With this small percentage of active agency in solution it is very essential that the Form or Mould which you use must not leak or absorb this vital element which is the strength part and that for which you pay your money and upon which you are depending to form your solid structure. The part which leaks out through the cracks and is absorbed by the use of a wooden Form is always that which is in solution. This is a positive loss, shamefully unnecessary. It is always that portion which is in solution as sand, gravel or stone will not soak into a plank, neither will it run out through a small crack but your strength element in solution will. This should be retained by all means, lest you deceive the builder also the state or community which in good faith pays out its money for that which it does not get.

To all appearances the sluice may look solid after the wooden Form is removed, however, every crack or uneven spot left by the wooden Form is very visible. The surface if closely examined with the naked eye will show thousands of small holes or voids which absorb the moisture which freezes in the cold weather and by expansion causes the concrete to flake or scale off. Then the manufacturer is to blame. Everybody agrees that it was poor cement. This is positively a rank injustice.

A well established law is that the same material cannot exist in two places at the same time. The strength part of this good cement got away and the only one to blame is the fellow who used the wooden Form and who has as a result, a poor and impoverished sluice for his labor.

With this Collapsible Steel Culvert Form or Mould you can use this very wet mixture which is essential to eliminate the voids without any danger of loss by absorption or leakage as the steel form is absolutely water-tight and the surface after the Form is withdrawn is perfectly smooth and shiny.

An arch has been adopted by reason of every law pertaining to the greatest amount of strength with

the least amount of material, this being so well understood, it will not be necessary to give any lengthy explanation. There is not in existence today a stone arch of masonry which if converted into a flat span, would sustain the weight of its own material, yet in the form of an arch it will stand a load equal to many hundreds of times its own weight.

As a crude illustration, the ordinary egg is composed of a lime-stone formation, a very thin spherical shell which shows wonderful strength. It is said that it is almost impossible for a strong man to crush one in his hand yet any semi-flat portion of this shell could readily be crumbled in the hands of an infant, a very strong argument in favor of an arched type of culvert.

One of the very distinct advantages in favor of the semi-arched type of sluice over the round, is its increased water carrying capacity. This is very essential where the surface of the road is thin, shallow or flat which is so prevalent throughout the country, in other words, the crown of the road is not far above the bottom of the ditches along the side of the road. In fact, starting from the center of the road, the surface gradually slopes downward until it forms the bottom of the ditch, being rather hard to distinguish where the road line starts and the ditch-line commences, usually determined by the water-level, meaning the depth of water in the ditch.

For example, a 12 inch round sluice will carry a given quantity of water when running full, the height of opening being the diameter of the pipe. With this 12 inch water-level in the side-ditches, the width of the road is determined by the water-level. With a 24 inch semi-arched concrete sluice, twice the quantity of water can be carried with the same amount of head-room, and the same amount of water can be carried with approximately a 4½-inch water-level in comparison with the 12 inch water-level with one-half the capacity. It is easily seen why the semi-arch has every advantage, in as much as the primary object in putting in any sluice is to carry the water from one side of the road to the other and to keep the water at the lowest possible level with an ample capacity for taking care of flooded conditions, especially in the spring of the year when the surface of the road becomes in a semi-liquid condition as the frost is leaving the ground. With the round sluice, owing to its limited capacity and excessively high water-level, in a great many instances, the water is forced to flow across the road, resulting in very extensive wash-out and the expenditure of vast sums of money for repair work, to be expended again and again as the condition reoccurs. "Larger Culverts, Lower Water-level." Drainage is the first principle in road building and great attention from every economic point of view



should be given to this essential in the building up of our Highways and reducing the cost of the upkeep.

With the established fact in mind that the same amount of material in the form of an arch over a given span has many hundreds of times the strength of a flat top over a given span, in fact if it was not monolithic in its nature, the flat top would not sustain the weight of its own material, is sufficient proof. It

might be possible to get the strength of an arch in a flat top if you used three or four times the amount of material. This, however, would necessitate a very thick top covering which would be extravagant and would make a rise in the surface of the road, which would be very objectionable, and thanks to our good Highway Laws of New York State, is not permissible.

The top part of the same Mould which is used in building the larger type of sluices is employed and can be easily withdrawn from the work a few hours afterward or as soon as the initial set takes place and the Mould can be passed on to the next "Job."

From an artistic point of view culverts built along these lines with the large head-walls and wing-walls, adorn the Highway. They are not hidden, blind and forgotten with the sod grown over their intake and outlet.

This new type of pressed Steel Collapsible Culvert Form has recently been put on the market by Edward J. Whalen, the inventor who is the originator and president of the Concrete Form Company, Inc., Syracuse, N. Y. It embodies all the good features of the present Style "A" and Style "B" Forms which are so well known, being in use in practically half the townships in the State of New York and over which thousands of the beautiful types of sluices have been built as shown by the accompanying half-tones contributed by Town Superintendents of New York State. The accompanying photographs show the various parts also a few of the different types to which these parts may be assembled. Any number of sizes, lengths and shapes can be built with this one Form which is complete in every detail to built sluices from 12 to 60 inches. Four sections are used, consisting of four semi-circular top sections 24 inch diameter with 12 inch radius, eight side-walls 14 inches high and four head-walls, two 48 inches square and two 48 by 82 inches. An adjustable parapet-box is used for forming the inner and outer sides of the head-walls, also two 38 by 40 inch triangle wing-walls. By a special arrangement culverts can be built at any angle across the road as illustrated.

One of the novel features is the steel plate coverings which are 2 by 3 feet and reinforced on their under side by sheet steel angles secured by an electric weld. These sheets when placed crosswise of the parallel Forms give a 60 inch span and when placed lengthwise give a 48 inch span. The Form in its natural position is 24 feet long, 24 inches wide and 27 inches high, built of special hot and patent cold rolled carbon steel plate, thoroughly galvanized inside and out and built to stand very hard and continued usage.

The collapsing feature is entirely in the top. It is so constructed that its line of support is inside of its line of circumference. After the concrete has taken its initial set, the spreader bars are released by a 12 foot draw-bar and the circumference decreases from 24 to 18 or 20 inches and the form is readily withdrawn.

In building the larger culverts over the 24 inch Form, it is accomplished by twining the 4 sections of one 24 foot Form into a 12 foot Form either 48 or 60 inch span. Intermediate sizes also may be built. The intervening space between the apex of one form and the other is covered by steel plates previously referred to.

The approximate weight of this Form complete is about 1600 lbs., yet it is so constructed that it can be easily set up or removed from a sluice by one man. Wonderful savings have been effected by the use of this Form in Culvert Construction throughout New York State. These facts can be verified by writing to almost any County or Town Superintendent in the State.

CRYSTAL SAND AND GRAVEL COMPANY.

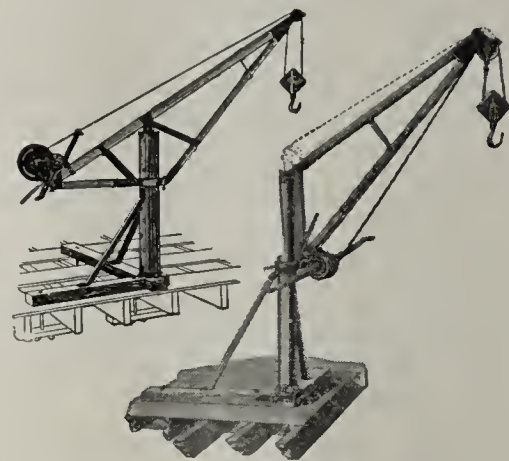
Mr. G. W. Farison, who recently leased the pits of the Crystal Sand and Gravel Company at Battle Creek, Mich., met with a fatal accident while getting things in shape to operate the plant. He went into the pits of the gravel beds and began to work at the sides with a pick. He only struck a few blows when hundreds of tons came down and covered him thirty feet, crushing him instantly. This sad accident, we are advised, will put the lease on the gravel beds on the market, giving a most excellent opportunity for some party to take up a good business. Mr. Farison had about completed the installation of a complete screening and washing plant.

NEW CONCRETE BRIDGE FOR CHATTANOOGA.

Ellis Soper, president of the Soper Engineering Company of Chattanooga, Tenn., has been selected as construction engineer for the Market Street bridge of that city. The design will be of concrete and will conform with government specifications. It will be a low bridge with a lift span over the water channel, the span being about 275 feet long and of steel construction. Mr. Soper's largest work in the South thus far has been the construction of the plant of the Dixie Portland Cement Company at Richard City.

NEW SASGEN DERRICK

Another new Sasgen derrick has just been put on the market by Sasgen Bros., 2053 Racine avenue, Chicago. This new one has a full circle swing and a double boom that will hoist a loaded wheelbarrow and let down the empty one at the same time. Can be used for hoisting loads from the outside or inside of the



building. Fitted so that the handles are continuously turned forward, as by shifting gears the drum will work either right or left, which makes it much more convenient than to turn the handles forward and backward, to raise and lower wheelbarrows. This winch is also equipped with a small gear which works on the collar around the mast. Write Sasgen Bros. for their Circular X and mention CEMENT AND ENGINEERING NEWS when writing them.

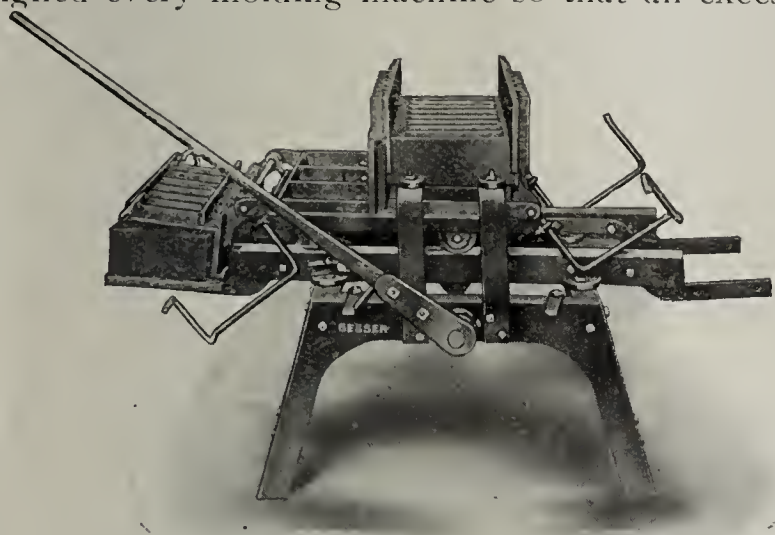
CEMENT RATES HALTED

Advances in the rates on cement in carloads from Chicago, Utica, Peoria, La Salle, Illinois, and other points to points in Iowa and other states proposed by the Chicago, Rock Island Pacific and the Minneapolis & St. Louis railroads, were suspended by the Interstate Commerce Commission today from July 18 and 30 respectively, until November 15. The advances would have amounted to from 1 to 2 cents per hundred pounds. The commission will conduct an investigation into reasonableness of the proposed tariffs. Tariffs on other roads naming similar advances were previously suspended in the same docket.

BESSER CONCRETE PRODUCT EQUIPMENT

The Besser Mfg. Co., 406 Fourteenth street, Alpena, Mich., are extending an invitation to concrete products manufacturers who want to make a better product—a larger output—or both. Mr. Besser says: "I am addressing this invitation to those manufacturers of concrete products who want to add new lines or who want to reduce the cost of manufacture on lines already in the plant.

"Besser machines for molding concrete products—brick, block, tile, pipe, etc.—are all designed with one cardinal principle. I don't believe in pressure. I have designed every molding machine so that an excess of



Besser Hand Brick Machine.

mixed material is fed into the molds and is compacted by tampers which drive just as far as the material allows. When the mold is full the excess of material is scraped off. You will never find a Besser block, brick or tile with a pocket or a weak spot in it.

"If you contemplate purchasing new equipment I want you to come up to Alpena this summer and see Besser machines in actual operation. It is a fine ride on the lake boats to this town and we'll see that your stay in Alpena is made a pleasant one. I'll pay the railway and boat fare of buyers, depending upon what equipment they purchase.



Making Sewer Pipe with Besser Hand Machine.

"Write me when you can come and just what machinery you think of buying. I'll write you definitely telling you just of the fare allowance in case you buy.

"If you can't come to Alpena and see this machinery in operation, tell me what you need and I'll do the best I can to give you a comprehensive idea of my equipment by letter and catalog.

"The Besser line of concrete machinery includes machines for hand and power operation for manu-

facturing block, brick, pipe and tile. We have a hand power face-down, wet mix block machine that has never been excelled in this particular line. We have machines of various sizes up to our No. 1 power brick machine with a capacity of 60,000 flint-hard tamped cement bricks per day, made at a factory cost of about \$4.00 per thousand. It will pay you to learn more about Besser equipment."

LUTEN DESIGN CONCRETE ARCH.

Daniel B. Luten, consulting engineer of Indianapolis, inventor of many patents on concrete bridges, is one of the most experienced and successful concrete bridge designers in the country. The vast amount of engineering work that he has done in the past sixteen years is well illustrated in a new catalog which contains photographs of many hundred concrete bridges built under his supervision. It is a striking example of the popularity of the concrete arch. He has also just issued a booklet entitled "Do Patents Prevent Progress in Concrete Bridge Design?" and we urge our readers to send for a copy, as it contains useful and interesting information concerning the Luten design concrete bridge.

United States patents to the number of thirty-nine, and containing four hundred and ten claims, have been granted to Mr. Luten for his own improvements in concrete bridges. Numerous suits for infringement have been filed under these patents and twenty-two decrees of injunction have already been issued. No suit based on a Luten patent has ever been dismissed, nor has any claim ever been found invalid.

State Engineer Gearhart of Kansas, and State Highway Engineer MacDonald of Iowa, have charged that the Luten patents constitute a complete monopoly of the concrete bridge business and that no concrete bridge whatever can be erected without infringing some claim of the Luten patents.

Were this true, it would only prove that those improvements that have made the concrete bridge a commercial success in spite of strenuous opposition from steel bridge interests, must have been first disclosed to the public in the Luten patents, and that, therefore, Luten is entitled to his royalties as his reward.

All Luten patents are open on an equal basis to all bidders except those under court injunction.

Suits for infringement under the Luten patents are never filed except under the most extreme provocation. Before a suit will be filed under these patents there must have been something more than mere infringement.

Designing engineers are never prosecuted under the Luten patents except when they oppose authorized Luten designs for their own infringing plans.

To avoid suit under the Luten patents, either do not infringe or if you will infringe be decent about it.

Those infringers who "knock" Luten designs and who violate the codes of ethics of engineering societies will be considered especially objectionable infringers.

The Luten patents constitute the strongest support for a code of ethics in concrete bridge design.

Some of the benefits resulting to the concrete bridge industry because of the Luten patents are shown in the illustrations and testimonials in his latest booklet. Without patent protection, how could any engineer afford to give the time to promote the industry as indicated by the articles on concrete bridges contributed to engineering journals by Daniel B. Luten? Approximately six thousand bridges of Luten design have been erected under the Luten patents, and the authorized business done under these patents has grown from \$400 in 1900 to \$2,000,000 in 1913.

MIXING AND DISTRIBUTING CONCRETE BY COMPRESSED AIR.

An unusual method for mixing and placing the concrete for lining a tunnel is being used by the Chicago, Burlington & Quincy Railroad in lining the Alkali Summit tunnel near Bonneville, Wyoming. This outfit is shown in the accompanying illustration and consists of a pneumatic mixer and conveyor mounted on a standard 40-foot flat car, together with bins which hold about 26 cubic yards of concrete materials, and carrying also a pipe through which the concrete, as it leaves the mixer, is forced directly into the forms through the bulkheads at the end.

The cement is stored in bags under one of the bins, which slope to the center of the car and discharge through chutes into a measuring hopper. This measuring hopper is lifted and tilted to discharge into the mixer by means of a cable operated by a small air cylinder.

The pipe which conveys the concrete from the mixer to the tunnel forms runs from the mixer under the

The mixer consists of a hollow cone with an air tight door at the top and a pipe connection at the bottom. After each batch is placed in the machine the door is closed by a small air cylinder and air is admitted to the machine in such a way as to thoroughly mix the batch and discharge it through the pipe to the forms. In this way the concrete is mixed and placed without labor and with no other equipment than pipe for transporting the concrete. Within ten seconds after water has been added to the cement the concrete is in place.

The amount of air which is required to operate the machine depends upon the length of the delivery pipe. This will also vary with the number of turns in the pipe line, with the kind of material used for aggregate, and with the vertical distance involved in the delivery.

It is demonstrated, however, that for general purposes of calculation, the amount of air will not exceed one cubic foot of free air compressed to 80 pounds for each lineal foot of 8-inch delivery pipe for each batch of concrete.



car and up at the end to the top of the bins, which are 14 feet above the rail, and then on an incline above the car to a point about 24 feet above the rail where it is in a position to discharge concrete through the bulkhead of the tunnel form. This pipe may be raised and lowered to clear the braces of the tunnel forms. It can also be moved to vary through angle of discharge, so that it can reach all parts of the work.

It requires but four men to operate the car, and the 26 yards of concrete materials which the bins hold may be mixed and placed in one hour.

Air and water are supplied to the car by pipes and hose running along the track. On this particular work, sections of ten feet are being done at one set of the machine. This is a matter which, however, depends to some extent upon the nature of the materials encountered in driving the tunnel.

This outfit was designed and installed by the Concrete Mixing & Placing Company, 123 West Madison street, Chicago, using one of the pneumatic mixers which this company is manufacturing.

LINK-BELT CONVEYORS

Book No. 189 just issued by the Link-Belt Company of Chicago and Philadelphia, and which will be sent to any of our readers, contains a few typical illustrations of Link-Belt machinery, and some of the elements used in their construction. The same careful planning, and attention to details, which have always characterized their work, will be found in Link-Belt stone, sand and gravel handling machinery, such as continuous bucket elevators, sprocket wheels, screens, belt conveyors, portable wagon loaders, locomotive cranes, clam shell buckets, car unloaders, etc.

Their engineering advice, based on long experience in designing and building this type of equipment, is at your service. Booklets illustrating and describing their various products will be mailed to interested parties upon request.

The Ste. St. Marie and the Fibron Quarry, who own and operate a large Bucyrus shovel are preparing to do a larger business this spring than ever before.

Economical Use of Small Mixer

By J. F. Gantz, Contractor, Columbus, O.

A machine mix is much more uniform and reliable than hand mixing, because the thoroughness of mixing is not dependent upon the fatigue or carelessness of the workmen.

In spite of the above fact, it is quite a common practice to resort to hand mixing on work on which a large mixer cannot be used to profitable advantage.

It is our contention that a small mixer can many times be used advantageously where a large mixer could not have been used. This point was forcibly illustrated in our recent work on a 30-inch concrete sewer in this city.

This sewer runs in the center of Twenty-sixth¹ street for a distance of four blocks as well as in a 14-foot alley for a distance of ten blocks. This necessarily meant that we had to work in a limited amount of space, and although we had a large concrete mixer, we did not figure on using it for this reason. However, we had our mixer boards on the job when we learned of the "Big-and-Little" mixer which we purchased. This mixer took up less space than our mixer board and we used it to a great advantage when mixing on the street, but when we got into the alley work, there was hardly room enough for the excavation; therefore, from the fact that the mixer was not too heavy and took up very little room, we put it on a platform right over the top of the excavation, and by so doing made a considerable saving.

The machine was equipped with a one-batch side loader which was easily hoisted to the dumping position. This outfit is compact, thus enabling the workmen on the job to move the mixer in a small fraction of the time required to move a large batch mixer; and in work requiring moving, such as sidewalk and sewer construction, the mixer frequently pays for itself in a few months' time by the greater economy in moving alone. We find it possible to conveniently keep this mixer in very best position for rapid work. One of these mixers and a small gang of men will lay from two to three times as much concrete as the same number of men will accomplish mixing by hand, and the concrete is of far better quality. On the job referred to, a considerable additional saving in labor was effected, as the concrete was discharged into the forms.

There were four men in the mixe crew, one for measuring of cement and operating the loader, one for proportioning of water and dumping the batch and two for wheeling to the side loader. A1-2-3 mix was used on this work. The average time consumed in batch mixing ranged from 20 to 60 seconds. We had 60 feet of 30-inch sewer forms on the job. When these forms were set we would commence mixing. The average time consumed was two hours to fill the 60 feet, which required about 9 cubic yards of material, showing a net cost of mixing per yard of about 30 cents, or a saving to me of about 90 cents per cubic yard on the mixing of concrete, to say nothing of the time gained, which was considerable and allowed me to complete this job long before I supposed, and take another and complete it this fall.

After our forms were filled we had to wait forty-eight hours before we could pull them and set ready to fill again; so, by having the mixer, we were able to complete the job in less time and with less men than we had figured.

This outfit demonstrated its practicability on this piece of work, and it is our opinion that some kinds of machinery that can be economically used in a larger unit cannot always be as economically used under all

conditions, on account of the fact that the depreciation of this machinery during the long part of the year it is not in use more than makes up for the saving effected by its use during a short part of the year. For example, if a contractor has a number of small and medium sized jobs, or large work on which space is too limited for use of large mixer, it would be economical to purchase and use a small concrete mixer. A small mixer will save nearly \$1 per cubic yard on concrete placed, and may be purchased for \$165 or \$250.

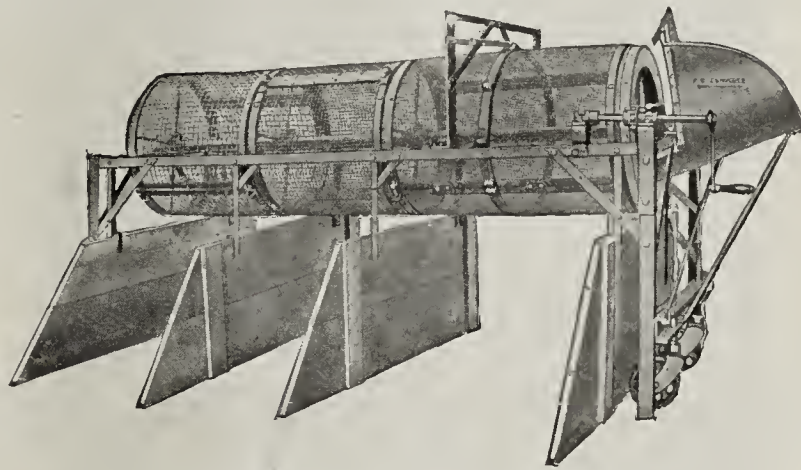
The mixing equipment used on this piece of construction was furnished by the Van Duzen-Roys Company, 4th floor, Hartman Bldg., Columbus, Ohio.

PORTABLE ROTARY SCREEN

A rotary screen designed to be readily portable and to replace hand screening is shown in the accompanying illustration.

The machine consists of a cylindrical screen of heavy wire cloth, arranged to be rotated either by hand or by power, mounted on a steel frame equipped with four wheels, allowing the screen to be moved from place to place on the work. The machine is made in several sizes. The one shown herewith is 7 feet long and 30 inches in diameter.

The cylinder is made up of three sections, each fitted with a screen of different mesh. Each section is



Portable Rotary Screen.

composed of two half-sections, which are removable and interchangeable to allow the use of any desired combination of screens. Bins for holding the separate sizes of stone may be made by means of board partitions, which are set up transversely under the cylinder, one at each end and one at each of the two intermediate points between screens of different sizes. These partitions are not furnished with the machine.

An automatic cleaner to prevent the clogging of the screen is attached to the frame near the charging end. As shown in the illustration, this consists of a steel frame carrying a hammer suspended over the top of the screen and operated by means of a steel band encircling the cylinder. This band carries sprockets which as the band revolves with the screen, raise the hammer several inches as they pass under it, allowing it to fall back and jar the fine particles out of the meshes.

For hand operating a crank is provided at the charging end of the machine. If it is desired to run the screen by power the crank is removed and replaced by a pulley. A chain transmits the motion from a small sprocket on the crank shaft to a larger one on the main shaft.

One or two men may be used to operate the screen. In the former case the operator alternately fills the charging hopper and turns the crank. Two men usu-

ally run the machine, one shoveling material and one turning the crank. When so operated, it is claimed, dry material can be screened as fast as one man can shovel.

The machine is made by the H. B. Sackett Company. Address them care of Cement & Engineering News, 1117 Schiller Bldg., Chicago, for circular, prices and information.

OLE CHRISTENSEN

Most of the fertilizer manufacturers will recognize the photograph of Mr. Ole Christensen, who for 15 years has been closely identified with the fertilizer industry as millwright and mechanical engineer in the employ of grinding mill manufacturers.



He has recently entered the employ of the Sturtevant Mill Company, the well known manufacturers of the Ring-Roll Mill, Newaygo Separator and other machinery used in fertilizer plants. He will act in the capacity of salesman and engineer-millwright and will travel extensively among the fertilizer manufacturers as heretofore with a greatly increased line of machinery.

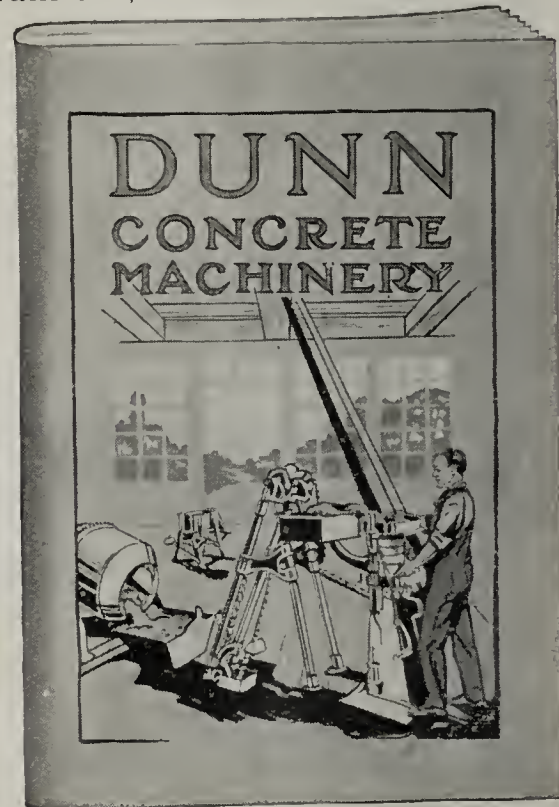
Mr. Christensen is highly popular among the users of pulverizing machinery, for his proverbial honesty and frankness begets confidence, and those who accept his advice seldom regret it, for his long and varied experience as grinding mill expert has taken him into nearly every plant in this country, and many abroad, so that he is qualified to judge the best and latest methods of mill practice and installation.

Few people have had this experience, and his present employers are indeed fortunate to secure the services of such a man, and also the Sturtevant Mill Company should be congratulated in having such high grade products to attract Mr. Christensen, for it is needless to say he would not in any event be connected with manufacturers building inferior machinery.

A VALUABLE BOOK ON THE CONCRETE BUSINESS.

What must be considered as one of the most interesting and instructive books on the concrete business, especially from the standpoint of its profit possibilities, is the new catalog of the W. E. Dunn Manufacturing Company, 4139 Fillmore street, Chicago, a copy of which has recently reached us. While primarily intended to describe Dunn machinery and molds, its treatment has been extended so that the reader can get a fairly accurate idea of what profits he can expect to make with the various products which the equipment manufactures.

The book measures nearly 8x11 inches and has 72 pages. The cover is printed in three colors—brown, green and silver—on a buff stock and is appropriately designed as shown by a reproduction. The first eight pages are printed in brown ink on India tinted antique paper, and are devoted to outlining the firm's selling policy of giving fifteen days' trial on any machine or mold before purchase is consummated. Several of these pages show some instructive data concerning the wonderful possibilities in manufacturing cement drain tile, and show how cement is supplant-



ing clay for tile in every section of the country. Tables of cost of manufacture and selling prices bear out the statement that this branch of the concrete products business is one that should not be overlooked.

The following 64 pages are printed in black on enameled book paper, and every page contains something of value to the progressive cement contractor. The descriptions of the various machines and molds is very thorough, yet not technical, and the quality of the various illustrations brings out the equipment as it actually exists. It is pleasing to note that no attempt has been made to belittle the equipment made by other concerns, although it has been found necessary to make comparisons in certain places in order to give reasons for the distinctive design of Dunn machines. A cursory glance through these pages shows that on page 41 are given the cost of manufacturing concrete fence posts; on page 45, the cost of producing concrete sewer pipe and large tile; on page 53 we get the cost of making concrete blocks; on page 57, the cost of making cement brick; the last pages being given up to describing Dunn ornamental molds, porch molds, etc., together with the cost of manufacture and selling prices.

All told, the book is an excellent example of co-operation between the manufacturer, writer, artist and printer in producing a book that men in the concrete business will appreciate and keep. A copy will be sent to any man interested upon request.

FLEXIBILITY

From a salesman's report, dated Dec. 8, 1913:

Mr. ~~██████████~~, superintendent of the ~~██████████~~ plant, advised that the Goodrich Conveyor Belt recently furnished them is one of the most satisfactory belts he has ever handled; it runs so absolutely true that he has removed every guide idler from the installation.

(We will furnish name of this plant upon request)



Makers of Goodrich Tires
and Everything
that's Best in Rubber

Factories:
Akron, Ohio

Goodrich
LONG LIFE MAXEGON
CONVEYOR BELTS
reduce tonnage costs

The B. F. Goodrich Company



There is nothing in
Goodrich Advertising that
isn't in Goodrich Goods

Branches in All
Principal Cities

Supremo Conveyor Belt

Adapted for all general requirements such as conveying gravel, cement, clinkers, crushed stone, grain, clay, wood-pulp, salt, tailings, etc. It is far above the so-called standard belt, and one that has given general satisfaction under more than ordinary conditions.

There is a diversified list of uses for Conveyor Belting. We have carefully studied the different conditions and materials and stand ready to construct a belt for the duty to be imposed, which is often of an abusive character. Conveyors for hot cement, hot coke or slag, crushed stone, silica sand, etc., represent a few of the extreme cases.

MANUFACTURED BY

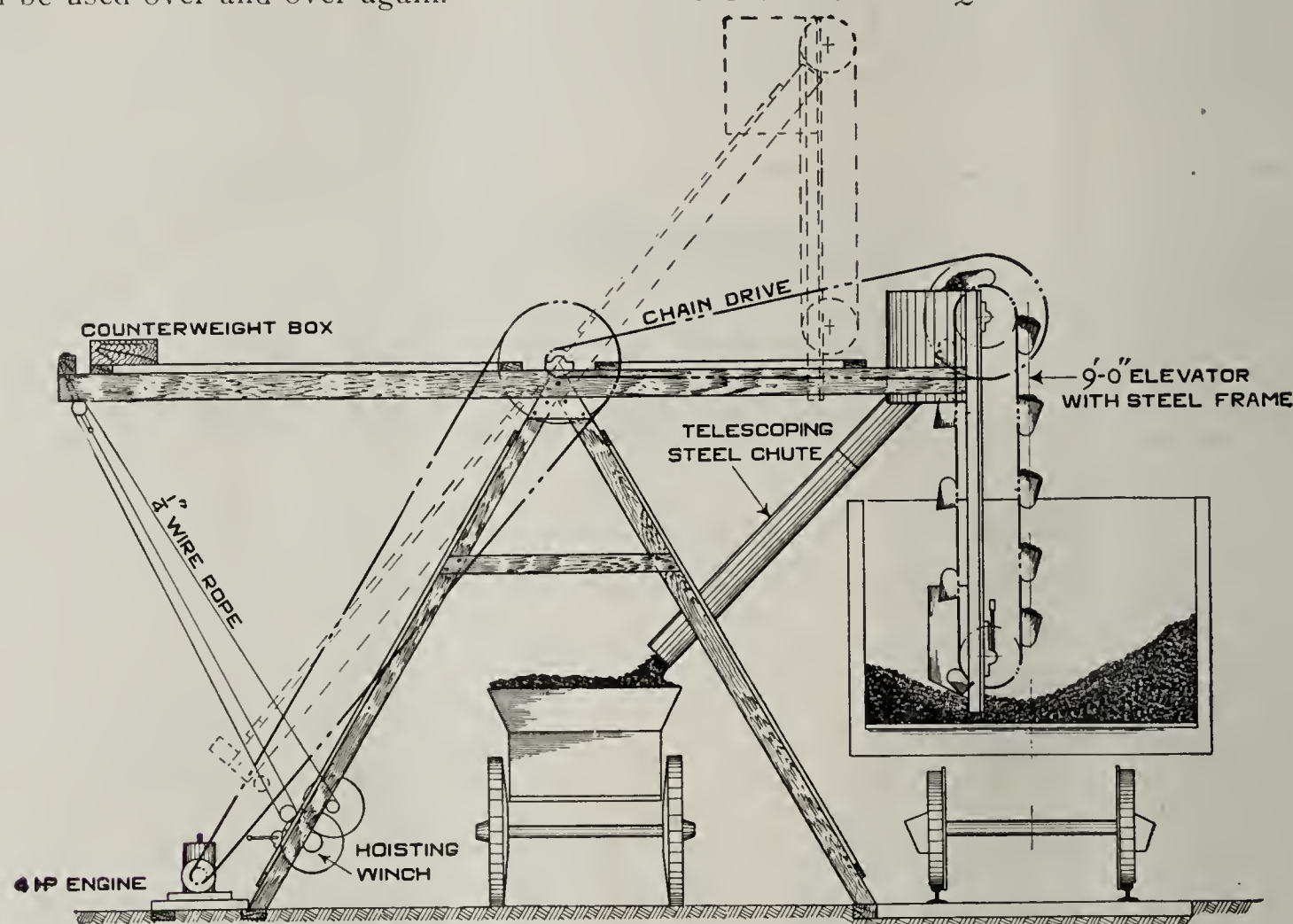
Revere Rubber Company
Chelsea, Mass.



CAR UNLOADER

The illustration on this page shows an inexpensive car unloader designed by the Link-Belt Company of Philadelphia and Chicago to meet the great demands of contractors and those who have to unload material quickly, for an economical machine to replace hand labor. The drawing easily explains itself. The bucket elevator which is lowered into the car raises the material to the telescoping spout which feeds directly into wagons or carts.

An outfit of this type will unload coal, sand, stone, gravel and similar material as rapidly as four to eight shovellers can do the work, depending of course upon the nature of the material handled. The equipment is operated by a gasoline engine and the entire outfit is extremely simple in first cost and operation. It can be dismantled and set up again at another point and in this way can be used over and over again.



SAND AND GRAVEL NEWS

At the instance of Mason Williams of San Antonio, attorney for the San Antonio Sand Company and the Lorraine Sand Company, the Railroad Commission, Austin, Texas, has granted time for the submission of a brief counter to the opinion rendered the Commission by Assistant Attorney General Luther Nickels in the matter of the complaint of the Wagner Sand Company against the San Antonio & Aransas Pass Railway Company alleging discrimination against it and in favor of the first two named concerns.

Mr. Nickels held that discrimination exists and that the Commission has authority to remedy it by either requiring free switching service to the Wagner sand pit, as is done for the other companies, or to reduce the rates for the Wagner company to consuming points.

In the brief to be filed Mr. Williams will show that contracts exist whereby the so-called free service is done in return for sand furnished the railroad for many purposes. Also, that the contracts are valid and that the propositions set forth in Mr. Nickel's opinion are not sound in law.

It will be up to the Commission to follow the opinion of one side or the other and make orders if it subscribed to that of the Attorney General. Litigation, it is said, will likely follow.

LIME PLANT REQUIRES HEAVY CONCRETE CONSTRUCTION

The White Rock Quarries of Bellefonte, Pa., have completed twelve new lime kilns at their Pleasant Gap plant. Some of the features of the plant are a 600-foot kiln trestle on concrete piers, each 10 feet high, two lime storage buildings of concrete and a large amount of concrete in the kiln seats, pedestals, building foundations, walls and piers.

Raw materials from the quarry come to the plant from a ground level approach, while coal is supplied from the trestle at an elevation of twelve feet above the fire door so that the material can be chuted to a point within reach of the fireman. Lime is drawn out of the kilns at a level ten feet below the firing door.

R. H. Appleby is superintendent and engineer for the White Rock Quarries.

COMPOSITE BRICK COMPANY

The name of the Roux Composite Brick Company, Plant City, Fla., has been changed to "Plant City Composite Brick Company." The plant was owned in part originally by E. T. Roux & Son, who sold their interest about a year ago to W. J. Carmichael.

There has been no change except in name, and those who have been operating the company's affairs so successfully will continue in charge.

FOR MANUFACTURING HIGH EXPLOSIVES

The E. I. du Pont de Nemours Powder Co., Wilmington, Del., has completed its high explosives factory, under construction for some months past at City Point, near Petersburg, Va. This plant is known as the company's Hopewell Works, and is one of the largest for the production of dynamite in this country. It includes 1,683 acres of land, on which have been erected about 80 plant buildings, 23 dwellings and one boarding-house, and the company has another dwelling in City Point. The plant was designed and built by the company, the machinery for manufacturing having been designed and constructed in the company's shop.

GOOD ROADS YEAR BOOK

Funds available in all of the states for the improvement of roads during the year 1914 are shown in the Official Good Roads Year Book issued by the American Highway Association, which is now ready for distribution. This is one of the new features of the book which will make it invaluable to every state, county and municipal highway official.

The Year Book discloses for the first time that appropriations by the State Legislatures for road improvement in the various states are available as follows:

Alabama, \$700,000; Arizona, \$535,724; Colorado, \$375,000; Delaware, \$110,000; Idaho, \$275,000; Illinois, \$1,300,000; Iowa, \$7,310,000; Kentucky, \$25,000; Maine, \$1,540,000; Maryland, \$3,700,000; Massachusetts, \$2,447,315; Michigan, \$4,183,972; Minnesota, \$5,672,254; Mississippi, \$1,720,000; New Jersey, \$750,000; New Mexico, \$387,194; New York, \$6,000,000; North Carolina, nearly \$5,000,000; North Dakota, \$2,365,000; Ohio, \$3,500,000; Oregon, \$3,288,000; Pennsylvania, \$3,500,000; South Carolina, \$1,000,000; Virginia, about \$2,000,000; West Virginia, \$2,286,557; and Wisconsin, \$1,230,000.

These interesting figures have been obtained from the officials of the various state highway departments and form merely one chapter of the year book, which covers every phase of the road movement in the United States. The year book lists all of the patents relative to roads and bridges, all road expenditures in recent years, all associations' work for road improvement, describes all the different methods of road construction and different road materials, giving a directory of all road bulletins, circulars, and documents of interest to persons working for better highways and for all officials engaged in supervising work on roads.

Sections of the year book are devoted to work in different states and the progress of road improvement. Engineers actually engaged in building roads as well as public spirited citizens who are working for better roads in the various communities have been waiting for the issuance of this volume by the American Highway Association and will find many features in it which do not appear in last year's edition. One of the interesting features, for instance, is the description of dust preventives, while one chapter is devoted to convict labor and another to the financial phase of road improvement.

A summary of the road laws in the various states is of particular interest to motorists, while descriptions of specifications for highways in the various states will be of interest to engineers. There is also a chapter devoted to important events in the road movement in 1913, and another section devoted to road systems in foreign countries.

The year book is issued annually by the American Highway Association, 708 Colorado Bldg., Washington, D. C., as part of its campaign to give the United States an adequate system of improved highways.

This Book will be sent on receipt of price (\$1.00) by Cement and Engineering News, Schiller Bldg., Chicago.

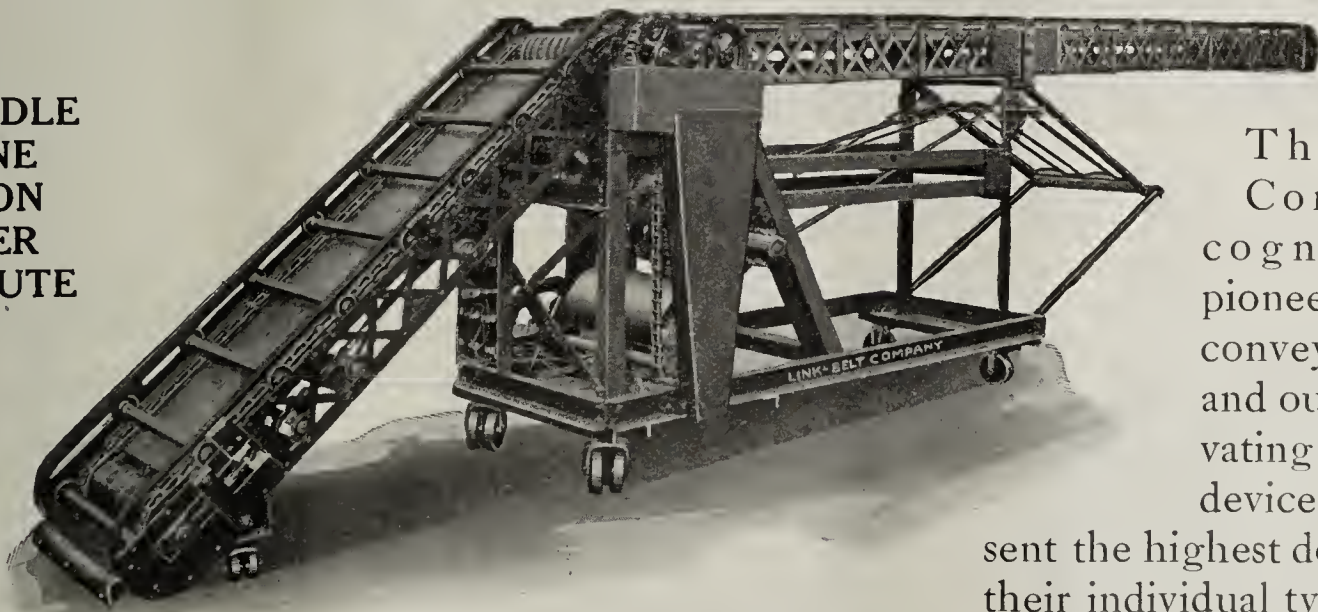
MICHIGAN QUARRIES

P. F. W. Timm, general superintendent Great Lakes Stone Company, is actively engaged at present in connection with the extension of docks and breakwaters at their new plant at Rockport, Michigan, and 14 miles from Alpena. J. W. Marsters is manager. The American Bridge Co. of Pittsburg has the contract for the steel work for new buildings.

LINK-BELT BAG PILERS

Cut down handling costs and increase the efficiency of your men

HANDLE
ONE
TON
PER
MINUTE



The Link - Belt Company is recognized as the pioneer in the art of conveying materials, and our various elevating and conveying devices to-day represent

the highest development of their individual types.

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Buffalo.....698 Ellicott Square
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Seattle.....512½ First Avenue, S.
Denver.....Lindrooth, Shubart & Co.

San Francisco.....N. D. Pelps, Sheldon Bldg.
New Orleans.....Whitney Supply Co.
Los Angeles.....204 No. Los Angeles St.
Detroit.....911 Dime Bank Bldg.

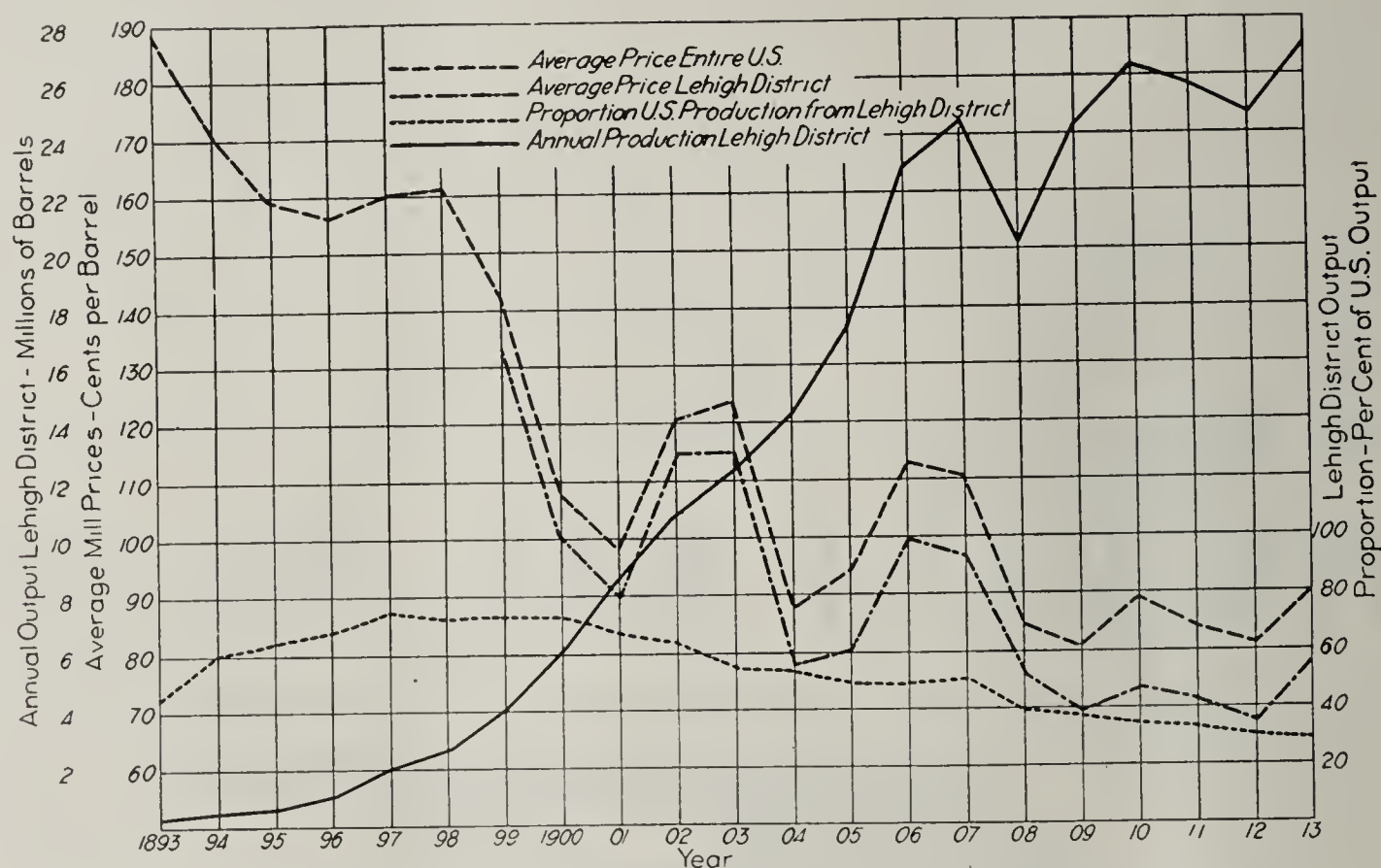
OUTPUT AND PRICE OF CEMENT IN THE LEHIGH DISTRICT

The general similarity of the price curve of cement to the same curve in the early history of the steel industry is suggestive. The periods of both high and low price have all been two years in length. Each period of high price has been followed by a new low record price. Each high point has been less than the preceding one, thus causing less effect on the general average price over a number of years; but the good years do not compensate for the poor ones.

The decline in price and the corresponding increase in output from 1893 to 1901 mark the introduction of the rotary kiln. The fact that there has been a steady increase in the output of the country as a whole seems very significant. The falling off in production in the Lehigh district in the years 1908, 1911 and 1912 were more than made up in the country as a whole. A large part of the demand in 1906 to 1908 was caused by the reconstruction in San Francisco after the fire and earthquake. The decreasing importance of the Lehigh district is partly to be expected as other plants are built in the South and West. The Hudson district

THE CEMENT SACK

Sack troubles are obnoxious to users of cement, but can, in a great measure, be avoided by a proper study of the question. The "Sack Morgue" displayed at the last Chicago Cement Show by the Universal Portland Cement Company illustrated in a graphic way the causes which lead to the destruction of cement sacks and the consequent financial loss. Mistreated and, therefore, useless sacks were displayed in little coffins with headstones explaining how each sack met its death. The "Morgue" proved so popular that it has been widely exhibited throughout the country. While in Milwaukee at the Builders' & Traders' Club it proved of so much interest that Congressman Carey and Mayor Bading praised it highly and the daily papers gave considerable space to it, while the Pennsylvania Coal & Supply Company, Universal dealers, brought all its yardmen to the exhibit to learn the lesson. It is planned to exhibit the "Morgue" at Indianapolis, Cleveland, Pittsburgh and other cities, and at the state fairs during the coming summer months. People interested in the proper handling of sacks will do well to visit the "Morgue" when it is displayed in their vicinity.



Cement Production and Prices in Lehigh District, 1893-1913

is cutting severely into the New York and New England trade. The decrease in output of the Lehigh district shows that the home market has not been developed to a point where the output of the mills can be absorbed, as the outlying territory has been taken over by local plants.

The steady downward tendency of the average prices, more especially in the past few years, indicates that greater economies will have to be practised or the price maintained at a somewhat higher figure. The latter would be somewhat difficult to accomplish in an industry as competitive as the cement industry. It may be accomplished in good years when all the mills have plenty of orders, but when the demand falls off the price is bound to be cut in order to get a larger share of the market. The price in the Lehigh district has been dropping away more and more from the average for the country

H. V. SCHREIBER.

CEMENT COMPANY ESTABLISHES RESEARCH BUREAU

The Universal Portland Cement Company has recently established a research bureau, the purpose of which is the analyzing and solving of perplexing problems that confront the cement industry. Possibly the most vital issue that confronts the manufacturer of cement today is the control and possible elimination of dust from kilns and dryers.

The dust problem, so called, is demanding the attention of scientific and practical minds in the cement industry throughout the world. It is essential that this problem be solved, for, with the constant increase of production, the escape and loss of dust become more apparent from day to day. Comparatively little has been published dealing with the dust problem, and this has been primarily along theoretical lines. Up to the present time no great or concerted effort has been made to solve this problem by scientific research.

Lansing Broncho Batch Mixer



\$200 and
up.

Sizes 7 to 10
15 Cu. Ft. Capacity

Better Than the Best

Only costs a fraction as much.

New 1914 Models

Here's the new 1914 Model Lansing Broncho—"The Daddy of All Mixers." A strong, powerful mixer that is better than the best and only costs a fraction as much. Not a cheaply made machine at a cheap price; but a high grade, first class mixer at popular price. A machine every contractor will be proud of. Strong where strength is needed. High wheels for easy moving; low intake for quick, easy loading, high discharge for wheelbarrows or forms. Easily cleaned; quickly and easily moved. Equipped with all of the latest and most modern devices, and built on the most modern and sensible lines, combining few wearing parts with great strength and speed.

**No Other Mixer
Combines ^{all} of These Features**

Low charging for wheelbarrows or shovels. Measuring hoppers for those who want them. Side loaders for big jobs; high discharge for wheelbarrows or forms; simple, strong, powerful engine; non-slopping rings; quick mixing principles; ball and socket fifth wheel for short turn, and to avoid racking of frame on uneven ground; few wearing parts for economical up-keep; high wheels for hauling steel drum; machined bearings; steel channel frame; friction clutch for starting and stopping; quick mixing, cleaning and dumping principles. Most mixers have some, but the Broncho combines all of them—the most satisfactory machine made from every required standpoint.

**1914 Models Are Marvels
of Strength and Speed**

They produce a quality of mix that every inspector accepts and pronounces *good*, doing it at most satisfactory rate of speed—600 batches and over per day, if required. Discharge operated instantly without the usual slopping. Mixer is reinforced, braced and strengthened at every possible wearing point. Machined track and bearings; channel iron frame (cross and corner braced), insuring the longest possible life and greatest wear. Designed to carry loads of from 1,000 to 5,000 pounds of concrete every batch, 10 hours a day, and 365 days in the year. Adopted by the largest and most exacting contractors in the country.

**—We Also—
Manufacture**

Continuous Mixers
Mortar Mixers
Hand and Power Mixers
Block & Brick Machines
Ornamental Moulds
Tools Barrows Carts
Scrapers Sand Screens
Mortar Hods
Mortar Trays, etc.

Send for Catalog

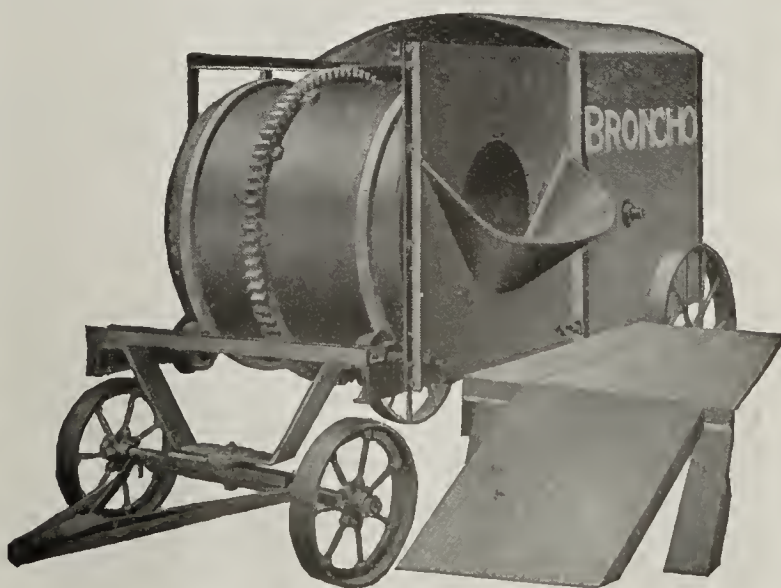
The Lansing BRONCHO is Truly the Biggest Value Ever Offered. You don't buy mixers every season and you don't have to with the Broncho. Every dollar saved in equipment is so much more profit, and

profits are what mixers are built for. Why invest in a cheaply built machine when you can get a well built, long wearing, well designed machine at the same price? Don't be content merely with a cheap mixer, but get a good mixer at a low cost. Do not invest a dollar in a concrete mixer until you have learned more about the Lansing Broncho. It is truly the biggest value ever offered in good machinery at low prices.

LANSING COMPANY
747 CEDAR ST. LANSING, MICH.

Branch Houses

New York Boston Philadelphia
Chicago Minneapolis
Kansas City San Francisco



Clifford W. Lyon has been appointed research engineer and will devote his entire time to the investigation and solution of the various operating problems that now confront the cement industry. Mr. Lyon has been connected with the cement industry since 1902, when he was superintendent of the Northampton Portland Cement Company at Stockertown, Pa. It was at this time that he entered the research field, making a study of kiln practice and of conserving and utilizing waste gases from rotary kilns, dryers, etc.

Since that time Mr. Lyon has been continuously connected with the cement industry, either in construction or reconstruction of cement plants, building machinery for cement plants, or as operating superintendent of active plants in the Lehigh Valley and Kansas fields. In the course of his work he has visited the greater part of the cement plants in this country.

BRADLEY HERCULES MILL AND GIANT GRIFFIN MILL

We take pleasure in announcing that we have just received order for Bradley Hercules equipments from the Lawrence Portland Cement Company, Siegfried, Pa., and the Whitehall Cement Mfg. Company, Cementon, Pa. This is a further demonstration of the practicability and successful operation of previous installations of this mill, writes the Bradley Pulverizer Company, Boston, Mass.

It is a well-known fact that cement manufacturers are through experimenting and are not buying pulverizing machinery unless they have investigated same thoroughly. Every Bradley Hercules Mill in operation has been breaking records for output and for small amount of horsepower used per ton of material ground. There is absolutely no other single mill

made that has given such complete satisfaction in such a short time.

The Bradley Hercules Mill when grinding clinker has an output of from 100 to 130 bbls. per hour used as a preliminary breaker, grinding to a fineness of 50 per cent through a 100-mesh sieve, using in the neighborhood of 175 h. p. When pulverizing limestone it has an output of from 30 to 40 tons per hour to the same fineness. This is a remarkable large output for the amount of horsepower used. The cost of upkeep is much less than that of any other preliminary grinder in use.

Reports given us on upkeep cost of grinding one-quarter of a million barrels of cement was much less than $\frac{1}{2}c$ per ton. This mill has done more to reduce the manufacturing cost of Portland cement than any other improvement that has been offered to the cement manufacturers since the long kiln was adopted.

This mill is not an experiment. Several plants have them in operation and all users are enthusiastic over their successful performance. It is our desire that investigators write direct to users and obtain from them direct their view of this mill as a cement material pulverizer.

During this age of low prices it is absolutely necessary to use the most economical machinery obtainable and we believe that in the Bradley Hercules Mill we have without a doubt the pulverizer which will do more to lower cost of manufacture in a double stage reduction grinding plant than any other mill ever used.

The Giant Griffin Mill is keeping up its remarkable reputation as a finishing mill, meeting all fineness requirements and operating at a lower horsepower consumption than that of any other finisher.

Descriptive literature and list of installations will gladly be sent to anyone desiring same.

THE BISHOP PATENT DERRICK EXCAVATOR

FOR HANDLING SAND, DIRT, GRAVEL, CRUSHED STONE, ETC.

There are only two machines that will dig material that is met with, and they are the steam shovel and the dipper dredge. By using the Bishop Patent Excavator, any derrick having a rectangular or a square boom can be converted into a steam shovel or a dipper dredge made out of a derrick boat.

This apparatus can dig anything a steam shovel will dig, and

its range is from the base of the derrick to the end of the boom and below the base of the derrick the length of the dipper arm.



WHY KEEP AN EXPENSIVE

steam shovel at work at the pit excavating sand and gravel when lower-cost equipment will do the same work? With your regular derrick you can dig material from the bank, you can excavate earth, you can handle loose materials on the construction job.

The Bishop Patent Derrick Excavator is an attachment that is readily adjusted on your derrick. It consists of a carriage traveling on the boom, a dipper and a dipper arm. A square or rectangular derrick boom, a double-drum engine and swinging gear are required. One man operates the equipment.

UNION IRON WORKS

HOBOKEN, ERIE SIDING, NEW JERSEY

Among The Cement Mills

CEMENT CO. BUYS ORANGE GROVES

The big chimneys at the plant of the California Portland Cement Company at Colton now can spout dust over the surrounding orange trees without danger of damage suits, for the reason that the corporation has bought all of the land within the danger zone.

Three appraisers, appointed by the Superior Court, made their final report yesterday, fixing the amount of damages and the purchase price for land which will be paid to sixteen orange growers. The corporation will pay \$92,450 for 125 acres of orange land and damages amounting to \$24,381, or a total of \$116,831.

When the \$1,000,000 plant was placed in operation in January, 1909, it began scattering cement dust at the rate of about 150 tons every twenty-four hours over a radius of one and one-half miles. Within thirty days all the houses in the town of Colton, the orange trees and every uncovered thing within the affected district was covered with an opaque coating of cement, which wouldn't wash off.

The sun-proof, moisture-proof coating of cement on the orange trees reduced the crop of golden fruit by one-half in the first season after the dust shower began. The blight subsequently reduced the orange crop to one-fourth of its former value.

In the summer of 1909 the orange growers who were neighbor to the dust-bellowing monsters obtained injunctions against the cement company and the plant was closed down, pending the work of installing dust-controlling equipment which cost \$300,000.

The first day that the dust-controlling plant was in operation it saved sixty tons of powdered cement,

which otherwise would have been scattered broadcast over the country to the dismay of the inhabitants. The device forces the flue gases through a long passageway and a shower bath which has the effect of settling the dust.

The dust-controlling device does not prevent the escape of all dust, but reduced the blighted zone to a radius of three-quarters of a mile. It is the land in this district which has been purchased by the corporation.

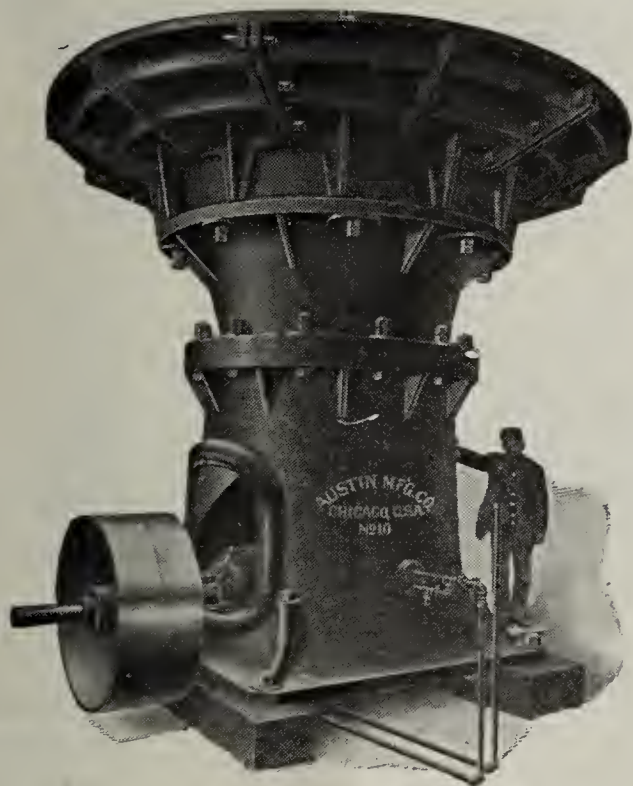
The cement company has use for only a small part of the high-priced orange land, which it has been forced to purchase. Three of the principal stockholders of the concern—Dan Murphy, T. J. Flemming and Willard H. Stimson—have been appointed as a board of trustees by the corporation to take over the land and devise some practical use for it. It is evident that it will not be profitable to attempt to grow oranges on the land.

CEMENT MILL NEWS

The Dexter Portland Cement Company, Nazareth Cement Company, Phoenix Portland Cement Company, Penn Allen Cement Company and the Bath Portland Cement Company, all of Northampton County, filed a complaint with the Public Service Commission of Pennsylvania against the Lehigh Valley Railroad, the Central Railroad of New Jersey, Delaware, Lackawanna and Western Railroad, Ironton Railroad Company, Lehigh and New England Railroad Company and the Bangor and Portland Railroad Company alleging discrimination in rates.

An increase of 10 cents per ton is alleged to be contrary to the tariffs filed by the railroad companies.

Austin Gyrotory Crushers



The World's leading Ore and Rock Crusher. Its many superior qualities and mechanical advantages have won the highest reputation amongst Mining Engineers and Quarrymen.

Made in NINE sizes with capacities from 50 to 5000 tons per day. Smaller sizes can be mounted as Portable Plants. Thousands in use. Plans and specifications furnished for any size of Plant.

Austin Manufacturing Company

CHICAGO -- NEW YORK

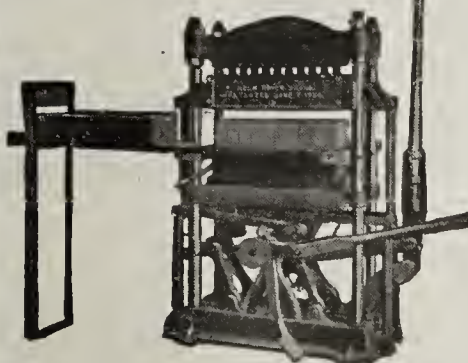
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Granite Brick Like This Pay \$5 to \$10 Profit a Thousand

Granite, marble, felspar, any kind of aggregate in fact, exposed in all its natural beauty and color on the face of cement brick and blocks without the use of chemical or acids.

Made on this Helm Press under 80,000 pounds pressure.



It will tell you all about Helm presses which make granite finish brick and block. Merely sign and send the coupon now while you think of it.

The texture may be coarse or fine. The face is readily waterproofed and is even stronger than the body of the brick or blocks. These brick are selling for \$15 to \$30 a thousand. Full instructions for making this product are furnished free with the Helm Press. This grade of cement brick and blocks is turned out very rapidly on this machine. Helm Presses are built in different sizes to operate by hand or power with no tamping required.

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HYDRATED LIME

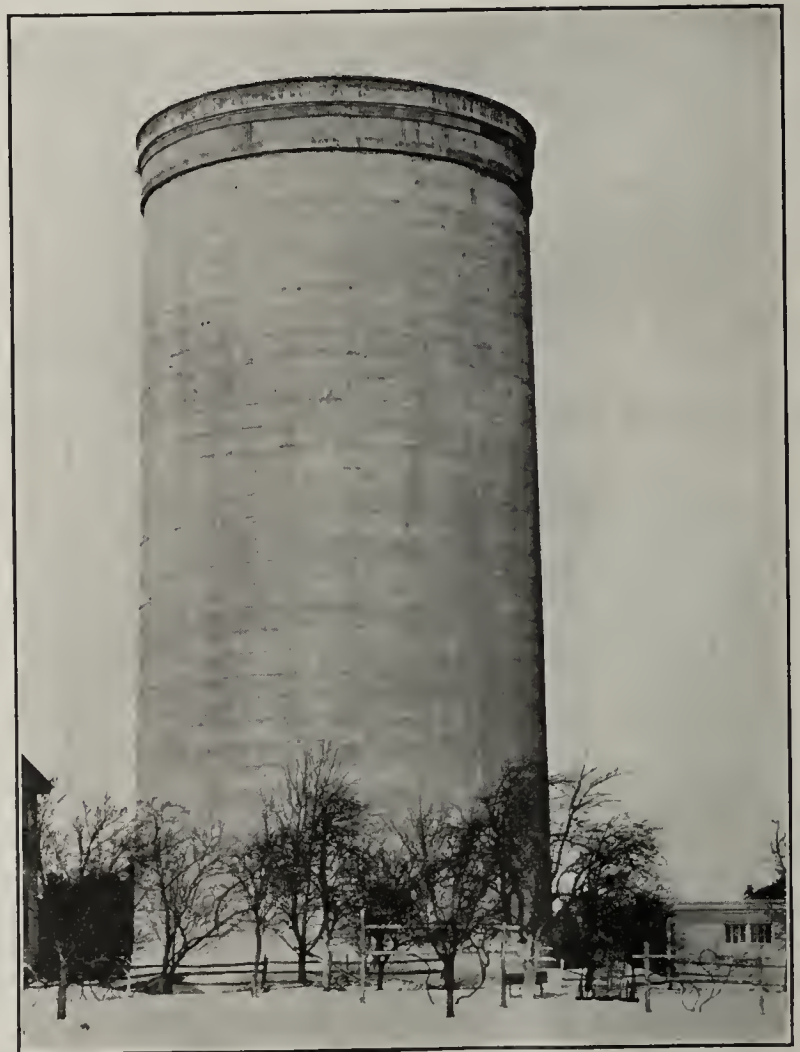
FOR WATERPROOFING CONCRETE

Hydrated Lime is not only the best but also the cheapest water proofing compound known, since it replaces so much cement and the only additional cost is the difference between the price of cement and hydrated lime, which is slight, even at the present low price of cement.

As an actual waterproofer, hydrated lime is not surpassed by any of the waxes and paraffin compounds at the present time used for this purpose. Many of these compounds are organic, and in time will volatilize, leaving the concrete porous. Hydrated lime, on the other hand, is inorganic or mineral, and will remain where it is put.

As an example of the waterproofing properties of hydrated lime, this was employed upon the large concrete reservoir at Rockland, Massachusetts, built by Simpson Bros. Corporation, the well known contractors and engineers, 166 Devonshire Street, Boston, Mass.

See next page for list of lime manufacturers who make hydrated lime and who will gladly furnish you samples, circulars and any information you desire.



Concrete Reservoir at
ROCKLAND, MASSACHUSETTS, ERECTED IN 1910
For the Towns of Rockland and Abington

Dimensions: 46 feet diameter; 104 feet high; capacity, 1,662,000 gallons. Designed and built by Simpson Bros. Corporation, Boston

To make this reservoir watertight, hydrated lime was added equal to 10 per cent. of the cement to the concrete when it was being mixed.

GETTING THERE FIRST.

It is easy enough to follow along with the crowd, to be one of the imitators and to take chances in a business from which the pioneers have skimmed the cream of the profits. It is a whole lot better, in our opinion, to be one of the leaders, to be a little in advance of the band wagon and show your friends, neighbors and clients that you can think for yourself as well as keeping fully informed on everything new in your line.

Every farmer now realizes that a silo is a business necessity and that he cannot make much of a profit on his farm without a silo. Yet we see many contractors who are standing idly by and letting the silo business get away from them. This business belongs to the contractor, and he is a poor contractor who allows any of it to get by him without at least figuring on the job.

When he comes to figuring on the concrete silo, however, he should see to it that he knows what he is doing and that he can complete it within the time required. To do this he must have proper equipment, equipment designed for silo construction.

Polk-Genung-Polk, Ft. Branch, Ind., have designed an apparatus and equipment for erecting silos. They have made a specialty of this equipment and they believe that a contractor should have no difficulty in cornering all the business in his vicinity when he uses their equipment. Their large catalogue shows some of the points of superiority of the Polk system and should be carefully read by every one of our readers. It will be sent free on request and it will show how the contractor is benefited by following the Polk system of construction.

CEMENT STORAGE TANKS

The Washington Portland Cement Company commenced work last week at Concrete, Wash., on a project to cost \$100,000, when the excavation was made for the first unit of six big cement storage tanks that constitute part of the plans of the company to take the place of and form an improvement upon the warehouse and storeroom facilities recently destroyed by fire.

Six cylindrical reinforced cement storage tanks, with a capacity of 75,000 barrels, will be constructed on the north side of the loading track to begin with. These will be followed later by six similar tanks on the south side of the track, giving, when completed, a storage capacity of about 160,000 barrels.

The construction throughout will be absolutely fire-proof. The tanks will be forty feet in diameter and forty feet high. Above the concrete roofs there will be a steel bridge connecting all the tanks and the design throughout and the placing of the various conveyors will be in accordance with the best modern practice.

Just east of the packing room used at present, the new packing house will be constructed, with dimensions 50x65 feet. This in turn will be connected with a sack warehouse 50x200 feet, with a twelve-foot platform. Both of these buildings will be of absolutely fire-proof construction, steel and concrete being the only building materials to be used.

TRADE NOTES

The Pacific Rock & Gravel Company, of Los Angeles, California, use a 60-ton Bucyrus steam shovel for digging and loading their gravel at their pit. This equipment gives entire satisfaction and they are well pleased.

HYDRATED LIME

is being demanded by engineers, architects, dealers, manufacturers, contractors and builders everywhere. It can be manufactured now as cheaply as quick lime and it possesses certain properties making it more useful and valuable to builders than ordinary quick lime. It requires, however, great care and extra costly machinery in the manufacture of hydrated lime.

Hydrated lime is shipped in bags the same as cement, making it easy to handle for both the contractor and dealer. It is not only the Best but also the Cheapest concrete waterproofing compound known.

Write for printed matter, information, etc., to any one of hydrated lime manufacturers listed below—the nearest to your city

Longview Lime Works,
Birmingham, Ala.

Charles Warner Co.,
Wilmington, Del.

Marblehead Lime Co.,
Chicago, Ill.

Ohio & Western Lime Co.,
Huntington, Ind.

Security Cement & Lime Co.,
Hagerstown, Md.

Lee Lime Co.,
Lee, Mass.

Charlevoix Rock Product Co.,
Charlevoix, Mich.

Glencoe Lime & Cement Co.,
St. Louis, Mo.

Dutchess County Lime Co.,
Scarborough-on-Hudson, N.Y.

Kelley Island Lime &
Transport Co.,
Cleveland, Ohio.

National Lime & Stone Co.,
Carey, Ohio.

John D. Owens & Son Co.,
Owens, Ohio.

National Mortar & Supply Co.,
Pittsburg, Pa.

Gager Lime & Mfg. Co.,
Chattanooga, Tenn.

Dittlinger Lime Co.,
New Braunfels, Tex.

Riverton Lime Co.,
Riverton, Va.

International Lime Co.,
Sumas, Wash.

Standard Lime & Stone
Co.,
Fond Du Lac, Wis.

Union Lime Co.,
Milwaukee, Wis.



A Ten Day Old Factory

KNOWING WHERE THE REAL PROFIT lies, the Norwalk Vault Company has just established in Long Island City a plant of its own to take care of the New York demand for cement burial vaults. This photograph, which, by the way, shows rather interestingly the simplicity of the molds and method of making, was taken there the week after work began.

The National Casket Company, after a thorough investigation of the merits of the Norwalk Vault, has undertaken to act as general sales agent for the Metropolitan district, and when the vault itself becomes fairly well known around New York, a splendid business is expected.

AS SOON AS THE NEW YORK FACTORY is fairly under way, the Norwalk Company expects to open up a similar establishment in another city—Boston or Philadelphia, perhaps. Atlanta probably will follow, then some city quite far West; and so on down the line, until the company is represented either by its own plant or by some equally efficient local manufacturer in every section capable of supporting a first class vault business.

NATURALLY, THE FIRST TERRITORY selected for development will be that in which there has already been built up a demand for a cement burial vault of some kind or other. Local manufacturers under the National Vault patents, however, may rest assured that they will not only be fully protected in all their rights, but that they will be regarded always by the reorganized Norwalk Company as full partners in the campaign for nation-wide supremacy of the National Vault.

MOREOVER, the Norwalk Vault Company would be glad at this time to hear from a dozen or more men, now making money manufacturing cement or concrete products, who would like to double or triple their present income by joining with the Norwalk Company and the 200 local National Vault manufacturers already in the field. The United States is pretty big; and for the Norwalk Company to cover it all with its own shops would take far too many years. There is, therefore, this opportunity for the right men to take over local manufacturing rights—and get in on the ground floor of what is to become one of the great manufacturing businesses of this country.

PLEASE DON'T CONFUSE this with the old-time peddling of molds for making cement vaults, as practiced by those companies that live on the profits from the sale of their molds to you and leave you to develop your sale of vaults as best you can. Even under these circumstances, a good many local agents are making money selling vaults. But the Norwalk Vault Company is no more in competition with these smaller companies than the Railroad is with the trolley company or the National Biscuit Company with the local bakery.

THE VALUE OF THE NORWALK LICENSE and of Norwalk sales co-operation will increase greatly as each territory now unoccupied is filled by the right man—and these territories today may be had by the **right man** for a cash outlay astonishingly disproportionate to the possibilities of cash return. But the prices go up on September 1st.

WHAT ABOUT YOUR TERRITORY? Are you capable of fitting in with a big national organization and taking care of your county, say? If you are, the amount of money you can make depends only on the size of your territory and your own enterprise. The business is there—waiting!

HERE IS A STEADY STAPLE manufacturing line for a practical concrete or cement man who is ambitious enough to want a business bigger than a street paving job or an artificial stone plant. Practically no competition. Potential demand almost unlimited. **Find out who has the rights in your territory.** If you could make good, send without delay for further particulars. Prices go up all along the line on September 1st, and again every six months or so thereafter. So immediate action may save you money.

The Norwalk Vault Company,

**38 Seminary Avenue
NORWALK, OHIO**

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

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JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, SEPTEMBER, 1914

SOUTH AMERICAN MARKETS INVITE
UNITED STATES INVASION

All South America is an enormous purchaser of the manufactured products of Europe. A large portion of this supply will be shut off during the next six months and possibly during the next year or two if the war continues. As many South American countries depend largely upon Europe for its absolute necessities, and a major part of these orders are placed but a short time ahead because of the excellence of the regular shipping facilities, they are now face to face with an immediate famine in the articles which they most generally import.

According to the latest available figures collated in the Pan-American union, the ten South American countries—Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela—annually import products valued at \$961,000,000. Of this there come from Europe products valued close to \$660,000,000. While Great Britain supplies products of this total to the value of approximately \$273,000,000, Germany, which is completely cut off by the war, supplies \$180,000,000; France, \$84,000,000; Italy, \$54,000,000; Belgium, \$47,000,000; Austria-Hungary, \$8,000,000; Netherlands, \$8,000,000; Switzerland, \$6,000,000, and other European countries lesser sums.

For comparison it can be stated that the average imports from the United States of these ten countries of South America amount to approximately \$155,000,000. Bearing the fact in mind that the commercial relationship of South America and Europe has been so well organized and systematized that seventy-five per cent of these imports are only ordered about a month or two months ahead of their delivery, it can be realized how soon the present supplies on hand in South America will be exhausted and that she must depend upon the United States to make up the deficiency. If the United States manufacturers and exporters will exert every effort to supply this emergency demand without increase of prices, or unnecessary delay they will accomplish great permanent good for themselves and the South American business interests alike.

The same compilation of figures shows that South America annually exports to foreign countries products valued at approximately \$1,177,000,000. Of this

total nearly \$700,000,000 go to Europe. Of these products Great Britain takes approximately \$270,000,000; Germany, \$157,000,000; France, \$104,000,000; Belgium, \$60,000,000; Netherlands, \$44,000,000; Italy, \$27,000,000; Austria-Hungary, \$22,000,000; with the remaining amount divided among different countries. For comparison, it can be stated that these ten countries of South America export to the United States annually products valued at approximately \$250,000,000.

With, therefore, their principal markets for their raw products temporarily closed against them, these ten countries are looking for a place to dispose of their accumulating stores, and if the importing interests of the United States, including the manufacturers of raw material, can relieve the situation by increasing their purchases they may save the South American business interests from a financial crisis.

As nearly 90 per cent of the exports and imports of these South American countries are carried in German, British and other European bottoms, which are now withdrawn from the sea, all of their principal ports, like Rio de Janeiro, Montevideo, Buenos Aires, Valparaiso, Callao and La Guaira are in a state equal to that of a formal blockade. The majority of these vessels will be absolutely unable to operate for many months and possibly for several years unless the situation is quickly remedied. There is no limit to the sufferings that will come to these countries and ports if their facilities for sending out their exports and bringing in the necessary imports are cut off. In this crisis it is to be sincerely hoped that the bill now being passed by the United States congress may be of great assistance in relieving the situation. That, however, can only point out the way. There must follow the placing upon the high seas to operate between the United States and the principal South American ports a fleet of vessels flying the American flag, and this can only be done by United States companies taking advantage of this act of congress and carrying out the provisions of this bill. As an example of the effect the war has on the cement business we reprint the following from the Chattanooga Times:

First among Chattanooga manufacturers to secure new business as a result of the European war is the Dixie Portland Cement company. Its first export of cement goes into territory in South America previously controlled by German and Belgium cement manufacturers.

Saturday the New Orleans representative of the Dixie Portland Cement company wired the local sales headquarters to rush four carloads of cement to New Orleans in time to be dispatched on a steamer that will depart for South America. Manager Richard Hardy said yesterday that he had not even learned to whom and where the cement had been sold, except that it will go to some city in South America. His representative in New Orleans will give him these minor details by letter.

An attractive rate was said to have been made by the Queen & Crescent system, which will encourage exports of cement if the South American market for American goods develops in accordance with predictions made by local shippers.

The only hindrance to exportation of American goods to South America is said to be the disorganized transportation facilities. All local freight agents handling export shipments have received circulars within the last few days advising them to discontinue issuing bills of lading over steamship lines owned and operated by European companies. Several of these have been maintaining lines between New Orleans and South America.

POINTS IN FAVOR OF THE STUCCO HOUSE

Applying the Metal Lath Direct to the Studding

The perfection of building materials designed to resist fire has been such that now a residence can be built, at least fire-retarding, at little or no increase of cost. The solid brick or stone wall in residences is a known quantity, the "poured concrete house" is not as yet so well established, but with non-burnable roofs, houses built any of these ways would afford the suggested needed protection.

Considerations of cost, however, enter often; also, architectural and esthetic reasons prevail to the extent of prompting a desire for "something different." The stucco house has been evolved from these conditions, and there is good reason for its popularity. There is nothing in building construction that so pleasingly harmonizes with nature's color tones as the soft gray of the stucco house; it looks permanent, too, like stone and brick, without the severity in its lines or excessive cost of construction.

The cry of "fake" and "sham" is periodically raised by the starving purist and the millionaire iconoclast at this form of construction. As a matter of fact "stucco applied to a wood skeleton is neither a false form of building nor an imitation, but merely a humble device invented by the forefathers of the Man of Moderate Means to keep out the elements by plastering their huts of reeds with a coating of mud." Stucco in the past was invariably employed to cover some foreign surface of unsightly appearance, and as such performs a legitimate office.

Stucco is sometimes applied to brick, also to wood lath and tile, and another popular combination is cement plaster on metal lath. This latter type applied over wood sheathing, the ordinary construction will cost about 3 per cent more than the ordinary clap-board wall used in a frame house, while a stucco wall built by fastening metal lath direct to the studding and back-plastering will cost less than frame construction and is superior to it for its insulating properties, rigidity, fire-resisting and enduring qualities.

Stucco on metal lath built in the manner suggested without sheathing, is recommended by the metal lath manufacturers as the result of extended research into the subject and any of the manufacturers could supply typical specifications.

In a fire test recently held at Cleveland, a stucco wall on metal lath like that recommended was subjected for two hours at a temperature of 1,700 degrees and then was flooded with water from the fire hydrant. The wall was still in a condition to protect adjoining premises when the test was concluded.

It is reasonable to believe that houses thus built, and with non-burnable roofs, will protect the lives and property of home-dwellers and absolutely prevent the spread of fire through a residence section.

Considerations of the public good as well as one's own comfort and peace of mind should prompt the builder of a house not to concentrate a pile of fuel conveniently equipped with flues in places where fire can be communicated either to or by them. This is being done every time a frame house is put up, and what is here advocated in the way of various suggestions as to fire-resisting construction should, if followed, go a long way toward reducing the present waste of created resources by fire.

The arguments for fire-resisting construction of residences should appeal strongly to the country or suburban dweller who is away from the fire-protection facilities of the city.

The attention of architects and builders has been much attracted of late to the new method of applying metal lath to the studding direct, as such construction reduces the cost appreciably.

The valuable fire-retarding qualities of the stucco house, together with its other advantages—that is, insulation, possibilities for architectural excellence, low cost of maintenance, enduring qualities and consequent graceful ageing, seems to make it fit well for the out-of-town house. Even though it wears well, the effect is such that one does not tire of it.

In this connection we reprint from the August Bulletin of the Associated Metal Lath Manufacturers, the standard specifications for applying exterior stucco in this method.

Specifications for Applying Metal Lath to the Stud Direct

The finishing coats are applied in the usual way.

Inside Waterproofing—(a) The faces of the stud and for one inch back of the face on each side where the plaster may come in contact with them, shall be thoroughly waterproofed with tar or asphalt.

(a) The first coat shall be applied to the outside of the lath and pushed through sufficiently to give a good key. Over the face of the studs the plaster shall be forced well through the lath in order to fill entirely the space between the lath and the stud. The backing coat shall be applied to the back of the lath and shall be thoroughly pushed back into the mortar with a clean wood trowel, but no rubbing of the surface shall be done after the pebbles are embedded.

Insulation (a) After the lath on the outside has been back-plastered, the air space may be divided by applying heavy building paper, quilting, felt or other suitable insulating material between the studs by nailing wood strips over folded ends of the material. This insulation should be so fastened as to clear the bridging, leaving the preponderance of the air space next to the plaster. Care must be taken to keep the insulating material clear of the outside plaster and make tight joints against the wood framing at the top and bottom of the spaces and against the bridging where the face intercepts.

Mortar Coats

Plaster.—(a) The first coats shall contain not more than two and one-half ($2\frac{1}{2}$) parts of sand to one (1) part of Portland cement by volume. If lime putty is added it shall not be in excess of one-third (1-3) of the volume of cement. Hair or fiber may be added.

Thickness of Coat.—(a) The first coat shall be at least $\frac{3}{8}$ in. thick over the face of the lath and project through behind the lath about $\frac{3}{8}$ in. The backing coat shall increase the thickness behind the lath to not less than $\frac{5}{8}$ in. The final coat shall not be less than $\frac{3}{8}$ in. thick.—Keith's Magazine.

CONCRETE ON THE FARM.

Concrete water tanks and troughs are as useful indoors as in the barnyard. There should be a concrete trough in the stable and a concrete cooling tank in the milk house. Nothing serves so well as concrete for underground cisterns and overhead tanks.

Concrete is the right material for farm construction, but concrete cannot stand bad usage. You could as well expect to save money by cutting down the oats in the horse's ration as to economize in your concrete by cutting down the amount of cement. Nor is it economy to use poor, dirty sand or poorly graded gravel. The extra labor of getting good sand and graded gravel will be more than paid for by the quality of the concrete.

The Decorative Possibilities of Concrete.

By C. W. Boynton and J. H. Libberton.

(Continued from page 210.)

It is not surprising that an individual directly connected with the cement industry as is Albert Moyer, should build of concrete, nor is it surprising that one who is so well versed in concrete construction should obtain very pleasing effects as indicated by the work

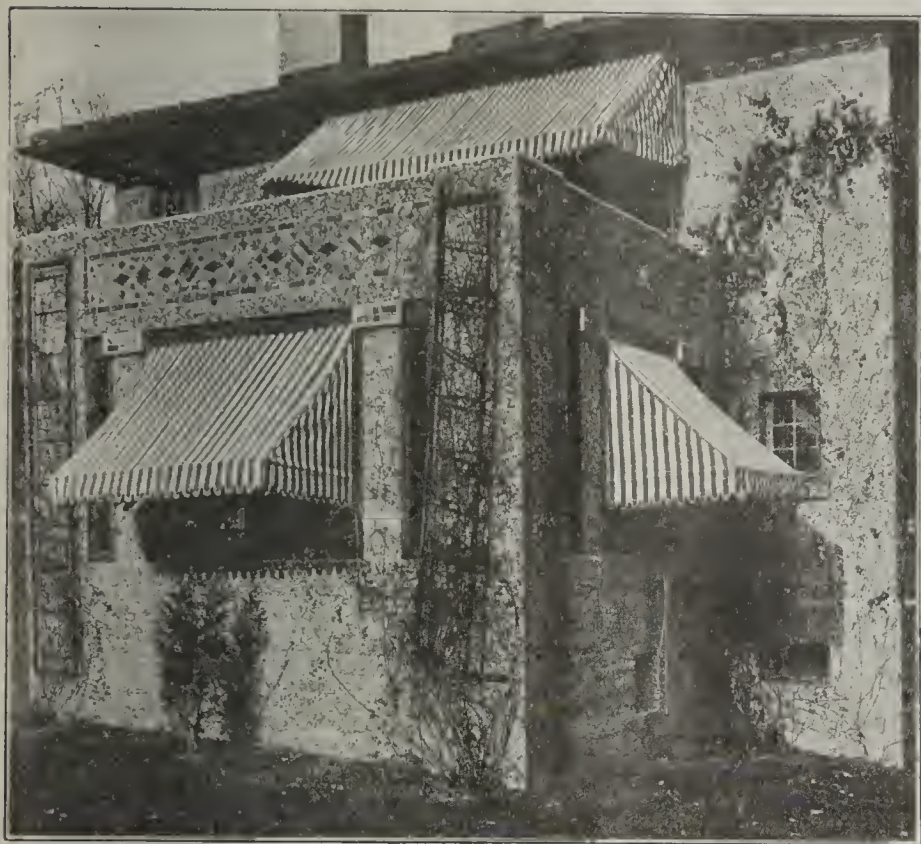


Fig. 35. Porch Detail. Residence of Albert Moyer, South Orange, N. J.

on his residence at South Orange, New Jersey. Liberal use has been made of exposed aggregates, employing a mixture of Portland cement with limestone screenings, marble chips, and dark trap rock (Fig. 35). Not stopping here, much dependence has been placed upon Moravian pottery decoration, which harmonizes well with the concrete surface, as is shown in the fireplace, with its inlaid panel showing an Indian at a fire, whether warming his hands or starting the blaze being not self-evident (Fig. 36). The balcony, also, has been worked out in pottery but somewhat differently than the fire-place. The distinguishing feature lies in the fact that instead of being inlaid, the figure comes out in bas-relief and although somewhat serpentine in design, seems fairly consistent with the grape-vine motive. Undoubtedly this panel would be somewhat softened to its improvement by the ivy which was evidently not in leaf when the picture was taken.

For some time, Alfred Hopkins, of New York City, has been a strong advocate of reinforced concrete for the construction of buildings and has added a large amount of information to our knowledge of the concrete of the old Romans, having investigated this point personally and in some detail. Nevertheless, Mr. Hopkins has never brought himself to believe that concrete should be used for the ornamentation upon buildings of the same material. For this purpose he advocates terra cotta, and judging from the excellent work which he has achieved on the residence of Charles E. Rushmore, there is reason in his contention (Fig. 37). This building is all of reinforced concrete to the roof and part of this has been constructed of concrete slabs. But for the panels and column capitals, Mr. Hopkins has turned to terra cotta tile, with excellent results. For the average individual, of course, a detail of this kind would be

prohibitive in cost. But with such a sized undertaking as this mammoth residence, the high individual cost of these panels (Fig. 38) is small when compared with the total cost of the building. However, with the advances which are being made in the use of colored aggregates, it is generally possible to obtain all the color variations necessary in the concrete itself.

It is not customary to build reinforced concrete roofs of the pitch type. In fact, there is no sensible reason for adhering to this construction when designing reinforced concrete (Fig. 39). The ideal concrete house is built with a flat roof not only because architecturally the design may be made pleasing, but because this type is the most economical in cost and space. An attic is of little use except for the storage of material which, in the majority of instances, will never be needed again, and when stored away in an attic corner, invites spontaneous combustion. Reinforced concrete has brought with it a new architecture and the sooner we appreciate its value, the earlier will be the general adoption of reinforced concrete for residences as well as the endless other types of construction to which it has already been applied.

Within the last few years, there has been a decided leaning toward the community settlement idea, and with this in view, the Forest Hills Gardens were designed (Fig. 40), not, as many people have inferred, an endowed neighborhood where buildings have been erected to house working people, but a business investment of the Russell Sage Foundation Company. It is in no sense managed as a charity, for whoever deals with it is expected to pay fair value for everything received. It is, however, an attempt to solve the housing problem for persons of modest means and its development will consequently be watched with interest. Perhaps this is the first example in America,



Fig. 36. Fireplace in the Home of Albert Moyer, South Orange, N. J.



Fig. 38. Porch Detail. Residence of Chas. E. Rushmore, Woodbury Falls, N. Y.

where an absolutely barren site has been taken and treated along the lines of modern methods of town planning. Throughout the village, advantage has been taken of practically every structural material for building the dwellings, but a large part of the improvements has been worked out in concrete, including the railroad station, the city market, and many of the individual dwellings as well as garden walls, foundations and the like.

Oswald Hering has utilized lattice work on one of his most important dwellings in combination with decoration of molded concrete. But where Mr. Hop-



Fig. 39. Cement Stucco Residence of L. G. Stumer, Chicago.

kins would use terra cotta, as in the panel inserts, Mr. Hering has used concrete, depending upon exposed aggregate to furnish the touch of color needed. Attention is directed to detail view of the summer house (Fig. 41), which better shows the green lattice harmonizing so well with the trees surrounding it upon every side. Within, the lattice idea has been continued, but in an entirely novel manner by simply stenciling the lines upon the wall, instead of using wood as in the exterior panels (Fig. 42). Such lattice work would not find great favor with the particular housewife because of the tedious work of dusting.

Wood paneling will also break up large areas of concrete surface and is entirely in keeping with the old half-timbered style of architecture, so familiar to our forefathers. It is impossible to appreciate the pleasing surface which has been obtained on this modest appearing dwelling (Fig. 43), but a slight explanation may help to make clear how the effect

is obtained. The finish is known as a dry dash and in this instance has been applied to concrete blocks. After the plaster coat has been placed, a dash mixture of white marble and blue stone chips with gravel screenings is thrown on, which imbed in the mortar and furnish a clean, bright surface without further treatment. When a coarser effect is desired it can be obtained by a rough cast, the mortar mixture be-



Fig. 40. Forest Hill Gardens, New York.

ing thrown on with a paddle and the texture of the surface depending entirely upon the size and character of the aggregate and the consistency of the mixture.

Stucco finish has found favor when applied to concrete blocks as a backing, and there are some architects who believe that this is the only satisfactory means of handling what has seemed to be in many cases a sad makeshift so far as a building material having architectural merit is concerned. This impression has probably grown from the continued manufacture of rock-faced and inferior blocks by those who are entirely unqualified to undertake this kind of work. Such examples as the Normal Park Methodist Church in Chicago (Fig. 44), the blocks for which were built



Fig. 42. Interior of G. E. Tarbell's Residence, Garden City, L. I., Showing Substitution of Fresco for Lattice.

by the American Hydraulic Stone Company, and the design executed by H. B. Wheelock, has done much to eliminate this impression. The tone contrast was here obtained entirely by the use of colored aggregates, using the natural sand finish on the trim but



Fig. 43. Residence, Jamaica Estate, L. I.

a dark granite for the body. The surfaces were then scrubbed to expose the aggregate and the building is itself a strong recommendation for the much maligned concrete block.

The residence of E. S. Harkness, at New London, Conn. (Fig. 45), is also of the same kind of blocks and depends for its merit not only upon a design appreciative of the value of the material but also upon the care in laying up the walls. Concrete blocks are not confined to exterior use, by any means, however, as is illustrated by the work of Emerson & Norris, on the interior of the Second National Bank Building in Boston (Fig. 46). A combination of a tooled surface with careful laying and a little introduction of



Fig. 44. Concrete Blocks in the Construction of the Normal Park Methodist Church, Chicago.



Fig. 48. Detail of Concrete Trim on Kingsbury Apartment Building, St. Louis, Mo.

cast stone work has made the interior of this structure not only dignified, but thoroughly cool and reposeful.

Oswald Hering says that the so-called dry process concrete block is not of concrete at all. Having had little acquaintance with water during its process of manufacture, it consequently harbors an unquenchable thirst and when used in the outside walls of a building, proceeds to make up for lost time, every rain-storm furnishing the elements of a "spree" to the detriment of the block and the appearance of the dwelling. The dry process, however, is not necessary, it being equally as easy to add enough water to insure excellent concrete. The possibility of careful inspection during its manufacture is a strong point in favor of the continued use of this really excellent building material.



Fig. 47. Kingsbury Apartments, St. Louis, Mo.

After considering the all-concrete buildings and the buildings in which other material has been used for ornamentation, it is interesting to turn to work where the latter condition has been reversed and is well illustrated by the work of S. T. Yourtee on the Kingsbury Apartments in St. Louis (Fig. 47). The blocks were cast in sand molds, and on account of the surface given by this method, subsequent treatment was unnecessary because of the peculiar matte surface which the rough sand mold provides (Fig. 48). Very intricate figures are easily worked out by this process and many buildings in St. Louis attest to Mr. Yourtee's skill in handling concrete.

(To be continued.)

TEN ACRES OF CONCRETE BUILDINGS CONSTRUCTED BY THE UNIT METHOD

Ten acres of one-story concrete buildings, costing \$300,000, have been erected by the unit method of construction for the Galveston Cotton Compress & Warehouse Company. All columns, girders and roof-slabs were cast in forms on the ground, the separately molded pieces were then raised into their proper places in the buildings and the joints were grouted with rich concrete. Concrete construction was selected primarily to reduce insurance rates on stored cotton. Since the new buildings have been in use the insurance rate has dropped from \$1.78 to 45 cents per annum, and it is claimed that a saving of \$750,000 has been effected by the use of fireproof construction.

The compress building, containing most of the machinery and about which the activities of the plant center, is 217 ft. long by 138 ft. wide. The classing sheds, which extend north and south from the compress, have sawtooth-roof construction throughout, to afford good lighting. The north shed is 486 ft. long by 138 ft. wide, and the south one 369 ft. by 138 ft. Sawtooth-roof construction is claimed to be particularly economical with the unit system of building. There are four so-called single warehouses, 185 ft. long by 80 ft. wide, and three double warehouses, 185 ft. long by 160 ft. wide. The outbound shed begins at the compress and extends east between two of the single warehouses to the unloading sheds at the east end of these warehouses. This outbound shed is 156 ft. 6 in. wide by 237 ft. long. The unloading shed extends the full length of the plant and adjoins the warehouses. The railroad switch tracks run along this shed, and all the cotton comes in here. It is 1,070 ft. long by 50 ft. wide, and the roof cantilevers over the box cars as they stand on the track.

All these various buildings total approximately 376,900 sq. ft. of floor area, or about 8.7 acres. The total area covered by the plant, including fire lanes, is 425x1,070 ft. or 10.5 acres, and provision is made for extensions to the west and south, which will eventually double the capacity of the plant. The cotton is handled by a very elaborate telpher system, which forms an unbroken chain from the unloading shed to the warehouses, from the warehouses to the classing sheds, from the classing sheds to the compress, and from the compress through the outbound shed to the tracks.

One of the construction features was the sawtooth roof over the classing sheds. The vertical frames which form the fronts of the sawtooth were cast in one piece and acted as the girder to support the roof slabs which form the slope of the sawtooth. One end of a roof slab rests at the bottom of one frame while the other end rests on the top of the frame one bay ahead. A tie beam from column to column makes the construction rigid. Instead of having windows in the vertical frames, openings were left and later covered on the inside with galvanized woven wire screening.

CONCRETE SEWER PIPE

"We have always noticed in your paper a commendable hesitancy about recounting the new-fangled uses of concrete unless these had been sufficiently investigated to warrant their general acceptance with the assurance of final satisfaction; but on page 182 of your July issue we read an article which leads us to believe that you have been misled by Mr. Wallace's glowing account of concrete pipe as used in Kansas City, and as described by him before the Illinois Society of Engineers and Surveyors," writes G. H. Tefft, secretary the International Clay Products Bureau, Kansas City, Mo.

"Your article states that full details are presented in a paper read before the annual meeting, etc., etc. Now, unfortunately, Mr. Wallace did not present full details. Several engineers who were present endeavored to bring some of these details out, but their discussion is necessarily short on account of the limited space available for their publication. The table of results which accompanied Mr. Wallace's article, for instance, did not appear, and this shows that the rejections of concrete pipe were twice as many as the rejections of clay pipe. He did not state that before the introduction of concrete pipe the expense of maintaining a special testing laboratory had never been found necessary, and that this expense more than offset the trifling saving in first cost which may have been brought about by the introduction of a new material.

"He did not state that he was personally interested in the sale of a testing machine, so that we might look for an over-enthusiastic account of the good results of his testing laboratory. He stated that since the instigation of his tests no failures of concrete pipe had occurred. This is grossly untrue. In order to show you how well pleased the citizens of Kansas City are with their experiment with concrete pipe, and how much money they think has been saved for them, we invite you to read the enclosed reprint from the Kansas City Star, giving certain testimony relating to this pipe, which testimony grew out of a libel suit brought by the concrete pipe manufacturers against the Kansas City Star for reporting utterances made at a meeting of indignant property owners.

"We, of course, are also interested parties; but, while Mr. Wallace is narrowly interested in the sale of a certain machine, we are broadly interested in maintaining a popular appreciation of first class standard materials for sanitation, and we have always felt that many cement engineers were with us in this effort; consequently we felt sure you will be glad to learn that your article on page 182 does not really do the situation justice and may mislead other cities less well informed into an attempt to profit by the purchase of structural gold bricks with the same unfortunate results already recorded in this city."

NEW BRIDGE DESIGNED FOR SAN ANTONIO.

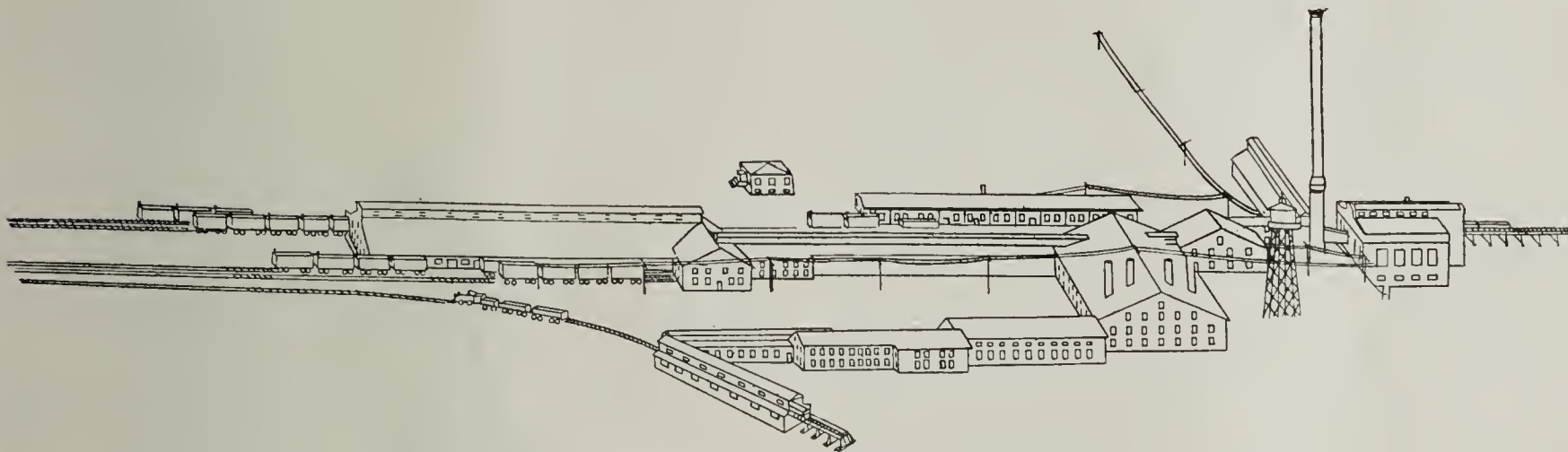
A. N. Nicoloyson, bridge engineer, under the supervision of City Engineer Helland, of San Antonio, Texas, has designed a fine new concrete girder bridge to span the Alazon Creek. This bridge will be the first to be erected in the residential section with the proceeds of the \$100,000 special bridge bond issue. Within about a month it is expected that bids will be asked for others of similar design. This one will be 65 feet long and 55½ feet wide, the roadway being 39 feet and the sidewalks 8 feet wide. In the center it is planned to erect two handsome luxolabra standards. Several other bridges are at present in the course of construction in the city.

The New Plant of the Edmonton Portland Cement Co.

The new plant of the Edmonton Portland Cement Company, Limited, is located in the Canadian Northwest and is at present the most northerly Portland cement manufacturing plant on the American continent. It is located at Marlboro, in the northwestern portion of the Province of Alberta, Canada, 140 miles west of the capital city of Edmonton. It is located on both the new trunk lines of the Grand Trunk Pacific and the Canadian Northern Railway, which at this point approach within 200 feet of each other and pass through the cement company's property, within a few hundred feet of the plant. Excellent competitive shipping facilities are thus provided, for a market which is growing at a rate unparalleled elsewhere on the continent. The raw materials which form the supply for this plant consist of a large bed of marl situated on both sides of the railways, at which the mill site is located, and a large bed of fine blue clay five miles east of the marl deposit. The composition, quality, and disposition of both materials are ideal for the

inclined runway and dumped alternately into one or the other hoppers of two Bonnot stone separators, which remove any stones, vegetable or other foreign matter that may accidentally find lodgment in the marl, and at the same time reduce the marl to a uniform consistency by forcing it through a highly perforated screening plate. From here the marl slurry passes through a measuring hopper into the slurry pug-mills.

The clay is excavated by a $\frac{3}{4}$ -yd. Hayward orange peel bucket on a locomotive crane, and loaded into bottom dump railway cars which enter the clay storage building on an elevated trestle and dump their load either directly into a 20-h. p. special clay disintegrator or into the storage trough beyond, from which it is conveyed by a pan conveyor to the disintegrator. The discharge from this disintegrator is elevated and fed into a special rotary clay dryer 6' in diameter by 80' long, arranged for induced draft, which is produced by a 60-in. exhaustor. From the



The new Edmonton cement mill. Peck carriers for hot clinker, made by Link Belt Company are installed in this mill, also Krupp ball mills, Jeffrey coal crushers, Urschel Bates Valve Bag machines, Bonnot steel rotary dryers, pug mills and Bonnot stone separators, also Allis-Chalmers D. C. motors and Allis-Chalmers turbogenerators.

manufacture of the highest grade Portland cement, the marl being high in lime, clean and comparatively uniform, such variation as there is occurring gradually, while the clay could not be surpassed for composition. It has a ratio of silica to alumina of about $2\frac{1}{2}$ to 1, is fine grained, uniform, easily accessible, with little or no stripping.

The company's holdings comprise 500 acres of marl land and the mill site, the marl running from 6' to 20' in depth, and 100 acres of clay land.

As the marl contains from 30% to 50% moisture as excavated in the field, the wet process is used, that is, the marl and clay are mixed into a thick slurry, pugged, stored and corrected, ground through wet tube mills and discharged into the kilns. The plant is one of the most modern, efficient and substantial to be found anywhere and has a 2,500 hp. generating plant with electric distribution and individual motor drives mostly direct-connected through gearing and friction clutches, thus avoiding the use of belting. The buildings are very substantially constructed of structural steel, brick and reinforced concrete, with a few timber frame buildings at the raw end.

The marl which lies directly adjacent to the plant is excavated by a drag scraper excavating apparatus, operated by a 75-h. p. electric hoist and is hauled in 2-yd. to 3-yd. batches by this same apparatus up an

discharge of the dryer the clay is elevated and fed into a No. 4 Krupp ball mill for reduction and deposited in an elevated clay storage bin. Here it is analyzed and discharged into steel measuring bins, measured by volume, and each batch conveyed and distributed evenly over the 2-yd. batch of marl in the aforementioned pug-mills, where it is thoroughly pugged and mixed for a period of 2 min. to 3 min. The pug-mills are extra large double shaft machines made by the Bonnot Co. and are operated, each by a 15-h. p. motor connected through gearing and friction clutches. From the pug-mills the slurry is elevated and distributed into six large steel slurry storage tanks 15' in diameter by 18' high. Here it gets its final analysis and correction.

The slurry is kept agitated in the tanks by means of compressed air blown in through four jets at the bottom of each tank. A system of piping is provided for withdrawing and conveying the slurry from the tanks to the slurry tube mills, into which it is uniformly fed by means of disc bucket feeders.

The tube mill building is equipped with five 5-ft. by 22-ft. wet grinding tube mills, lined for 18' with hard maple blocks on end grain, and for 4' at the feed end with chilled cast iron plates. Danish flint pebbles and steel balls are employed for grinding. The tube mills are driven by individual 75 h. p. motors, gear

connected, with a 40-in. Dodge friction clutch. The ground slurry discharged from the tube mills is conveyed to an auxiliary reservoir situated between the tube mills and the upper end of the kilns, and in this reservoir is installed a Harris compressed air pumping system to elevate and convey the slurry through suitable piping to the kiln feeders. These latter are disc bucket feeders of special design, driven by a wire rope drive from the kiln driving gear.

There are at present installed three rotary steel kilns 8' in diameter by 140 feet long with provisions for installations of a fourth one of the same size. Each kiln is mounted on two sets of cradle roller bearings and is driven through a train of gearing by a variable speed 10-h. p. motor, the controller for which is set at the front or firing end of the kiln, within easy reach of the burner. The kilns are special design and were built to order. The steel shell is built up of $\frac{3}{4}$ -in. plates except for a distance of 26' at the feed end, where $\frac{1}{2}$ -in. plate is used. Plates of the largest dimensions obtainable were used with the result that a large proportion of the butt straps generally used are eliminated and the total weight of the shell reduced accordingly. The kilns are lined with 9" of fire brick in the hot zone, 6" for the balance up to within 26' of the feed end, where no lining is used but shell plates are riveted to the shell. Pulverized coal is blown into the kilns by individual volume exhausters, through a 10-in. feed pipe which discharges into eight 4-in. nozzles at the firing hood. The blowers are specially mounted and are direct-connected to 15-h. p. motors, and a Reeves variable speed device is used to regulate the feed of the spiral screw coal feeding apparatus.

At the front or discharge end of each kiln is a cooling and economizing chamber, through which the hot clinker drops over a series of baffle plates on its way down to the conveyor, which carries it to the clinker storage, and through this chamber is drawn all air required for blowing the pulverized coal into the kilns and properly combusting it. All open joints and contact surfaces in the kilns are sealed with asbestos packing or gaskets, to prevent as far as possible the leakage of cold air into the kilns. A Peck, 24-in. endless gravity bucket conveyor, made by the Link Belt Co., Chicago, receives the hot clinker from the cooling chamber and carries it to the clinker storage. At the rear of each kiln is a dust settling chamber where the bulk of the stack dust is deposited and automatically conveyed to the kilns. It is expected that with the long kilns used and the wet process, there will be very little waste through loss of stack dust or heat lost in stack gases.

Clinker Storage. The clinker storage building is 44' wide by 195' long, built of reinforced concrete retaining walls and with a steel frame roof, and has a capacity of 60,000 bbls. of clinker. It has two concrete lined tunnels underneath and a monitor above for accommodating two 24-in. Peck gravity bucket conveyors, which encircle the building longitudinally, one bringing in hot clinkers from the kilns and the other carrying cold clinkers to the ball mills. The cold clinker tunnel is provided with cast iron gates for withdrawing the clinker from the storage through a portable 24-in. Dodge jaw crusher running on a track over the conveyor, which is set under any particular chute and is provided with a by-pass so as to crush only that clinker exceeding 2" in size on its way from the chute to the conveyor. The floor of the clinker storage is inclined toward the hopper openings in the tunnel and so arranged that very little hand trimming is necessary to withdraw the entire contents.

Ball mills and tube mills are employed for grinding the clinker. The equipment consists of four No.

8 Krupp ball mills and five 5-ft. by 22-ft. dry grinding tube mills. The ball mills are mounted on reinforced concrete piers and are driven by 40-h. p. motors connected through gearing and friction clutches. As the clinker comes from the storage it is first deposited in a large steel quadruple hopper feed bin over the ball mills, from which it is uniformly fed into the ball mills by Allis-Chalmers 12-in. reciprocating feeders. The output of the ball mills is elevated to a steel measuring bin, where the clinker and gypsum are mixed in proportion by weight and from there conveyed to the clinker tube mill feed bins.

There are at present installed five tube mills with provisions for the addition of another one. These mills are fitted with chilled iron linings and steel ball compartment and with Chalmers & Williams rotary feeders. Each mill is driven by a 75-h. p. motor, direct connected through gearing with a 40-in. friction clutch.

Gypsum. The gypsum department consists of a concrete storage bin adjacent to the railroad track, a 24-ft rotary dryer and a No. 1 Krupp ball mill, arranged to discharge one into the other and finally discharge the dried and ground gypsum into the gypsum measuring bin, adjoining it.

The finished cement, as it comes from the clinker tube mills, is elevated onto a 24-in. rubber belt conveyor in the monitor of the cement warehouse roof and conveyed to one or more of the twenty bins into which the warehouse is divided.

The warehouse building itself is of elevator or plank construction, with concrete hopper bottom under each bin leading to chutes in the two concrete lined tunnels under the bins. These tunnels accommodate screw conveyors, by which the cement is drawn from the different bins to the packing room at one end of the building.

The packing room is equipped with one Bates 4-tube packer, furnished by Urschel-Bates Valve Bag Co., with provisions for the installation of a second machine. The warehouse has a capacity of 80,000 bbls. of finished cement and four loading tracks, two on each side of the warehouse allow ample car storage and quick loading.

Coal abounds in the country east, south and west of the cement plant within a radius of 50 miles and coal suitable for burning cement and for steaming is now being laid down at the mill at a very low cost.

The coal for burning cement is dumped directly from bottom dump railway cars into a hopper under the track and passes through a Jeffrey single roll crusher into a 24-in. Peck gravity bucket conveyor which encircles the coal storage building, the coal dump and the coal dryer building, so that the coal can be deposited either in the coal storage or conveyed directly to the coal dryer. An auxiliary chute allows coal from this storage to be discharged over into the power house conveyor and thence into the boiler bunkers.

The coal dryer is of special design and consists of a rotary steel shell built to order by the Bonnot Co., 7' in diameter by 52' long, provided with diaphragms and shelf plates. It is set in a brick housing with furnace and baffle walls arranged so as to be outside fired by the initial heat and internally by the partly cooled return gases, which are free from flame or spark. A 60-in. exhaustor draws the hot gases around and through this dryer. From the dryer the coal is passed through a 24-in. by 18-in. Jeffrey coal disintegrator, and if necessary through 24-in. by 14-in. coal rolls and finally pulverized through two 5-ft. by 22-ft. dry grinding tube mills, from which it is elevated and conveyed to the coal dust hoppers over the kilns. These

hoppers are made to hold about twelve hours' supply and discharge directly into the coal feeding apparatus for the kilns. The coal storage building is of a construction similar to that of the clinker storage building, has reinforced concrete retaining walls with a steel frame roof, a concrete lined tunnel underneath and a monitor on the roof to enclose the 24-in. Peck conveyor which encircles this building, the track hopper and coal dryer.

The motive power for the entire plant is supplied by two Parsons steam turbogenerators, made by Allis-Chalmers Co., and distributed throughout the plant by electric transmission, nearly every machine being driven by its own individual motor drive. The power house is a handsome brick and steel building divided into boiler room and engine room, with basement for auxiliary apparatus. The equipment is very complete and all of the highest grade, and the whole design and arrangement of the power house make it one of the most compact and efficient in the Dominion. The boiler room is equipped with four 350-h. p. water tube boilers, fitted with automatic chain grate stokers. A parabolic steel coal bunker extends over the front of the four boilers, from which coal is chuted onto the stokers, the chain grates providing an automatic feed.

An endless 24-in. gravity bucket conveyor encircles the boiler room, passing over the coal bunker and through a tunnel under the ash pit discharge, thus serving to handle both materials. The coal for steaming is brought in on an elevated trestle alongside the power house and dumped from the railroad cars directly into the conveyor under the ash pits and elevated into the boiler coal bunker overhead.

The equipment in the engine room consists of one 1,000-k. w. and one 650-k. w. Parsons 3,600 r. p. m. turbo-generator; two 40-k. w. 125-volt exciters direct connected to 75-h. p. Robb-Armstrong high speed engines, a nine-panel marble switchboard, Alberger pumps, Blake-Knowles water heater and boiler feed pumps, low service pumps, and other auxiliary apparatus.

Water for condensing and all other requirements is obtained by diverting the course of a creek, so as to flow through a concrete intake well at the power house. The water supply and fire protection system for the plant and village consists of two single stage 6-in. turbine pumps, one motor driven and the other driven by a 35-h. p. Kerr steam turbine, a 50,000-gal. tank on a 75-ft. tower and about 3,000 ft. of 6-in. and 8-in. seamless steel water pipe main, with hydrants, valves, etc.

As the mill is located some distance from Edmonton and from machine shop facilities, it was necessary to provide a comparatively large and well equipped machine shop and supply house. This is housed in a one story brick building 44'x210', divided into wood shop, machine shop and blacksmith shop and supplies room. The machinery equipment includes iron lathes, planer, radial drill, sensitive drill, pipe and bolt cutter, power forge, emery wheels, wood-working machinery and all kinds of bench tools.

It has been the endeavor to keep the different departments or allied departments distinct and separate and each department is enclosed as far as practicable by a separate building. In order to avoid the dust nuisance as much as possible, all conveyors and elevators and dusty compartments are covered or totally enclosed.

The structural steel work for buildings and framing was all designed by the company's engineers and built and erected by the Canada Foundry Co., Toronto. The corrugated steel covering was supplied by Thos. Irwin & Son, Hamilton, Ont. The d. c. motors in the power house were supplied by the Allis-

Chalmers Manf. Co., Milwaukee, and the Northern Electric Co. of Canada supplied the switchboard apparatus. All motors are provided with starting compensators, no-voltage release, and overload relays.

As this plant was built in a new and unsettled territory accommodations had to be provided for all workmen and a model village has been laid out and is in process of development.

TESTS OF BOND BETWEEN CONCRETE AND STEEL.

"Tests of Bond Between Concrete and Steel," by Duff A. Abrams, is issued as Bulletin No. 71 of the Engineering Experiment Station of the University of Illinois. The bulletin furnishes one of the most exhaustive studies of the amount and distribution of the bond stress between concrete and steel which has appeared. The results of tests of about 1,500 pull-out specimens and 110 large reinforced concrete beams are given. The tests covered a wide range of ages, mixes, size of bar, length of embedment, condition of storage, method of applying the load, etc. Both plain and deformed steel bars were used.

Bond resistance may be divided into two principal elements, adhesive resistance and sliding resistance. In all of the tests measurements were made to determine the relation of slip of bar through the concrete to the bond resistance at different stages of the tests. A considerable bond resistance is developed before a measurable slip is produced. It was found that after slipping begins there is a well-defined relation between the amount of slip of bar and the bond resistance for small slips. For plain bars slip begins at about 60 per cent. of the maximum bond resistance; with further slip the bond resistance increases rapidly until a slip of about 0.01 inch is reached, which represents the maximum bond resistance. The amount of slip corresponding to a given percentage of the maximum bond resistance is remarkably constant for a wide range of ages, mixes, conditions of storage, etc. Slip of bar begins at a bond stress equal to about one-sixth the compressive strength of cubes made from the same concrete. The maximum bond resistance is equal to about one-fourth the cube compressive strength.

For deformed bars the relation of slip of bar to the bond resistance was not materially different from that of plain bars during the early stages of the test; during the later stages of the test the bond resistance varied widely with the type of bar and was found to depend on the area and slope of the bearing surfaces presented by the projections of the bar.

Twisted square bars were found to be inferior to plain round bars on the basis of bond resistance per unit of area of the surface of the bar.

The usual method of computing the bond stress in a reinforced concrete beam does not take account of all the phenomena of bond action. Slip was first observed in the middle region of the span at loads producing a tensile stress in the reinforcement of about 6,000 pounds per square inch. As the load was increased slip of bar progressed through the outer thirds toward the ends of the beam. In the beams reinforced with plain bars end slip began at about 67 per cent of the maximum load; for the beams with certain types of deformed bars the value was 51 per cent. In the tests of reinforced concrete beams it was found that a very small amount of end slip represented critical conditions of bond stress.

Copies of Bulletin No. 71 may be obtained gratis upon application to C. R. Richards, Acting Director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

CONCRETE DRAIN TILE

The constantly increasing value of farm land is compelling the farmer to utilize every available foot of his premises. Fields formerly swampy or under water are being drained and used. This has led to a constantly increasing demand for drain tile of all sizes.

The farmer, however, often finds it difficult to procure drain tile which will meet his needs. The ordinary clay tile has, in a majority of cases, to be shipped from some distant point, with consequent loss due to transportation charges and breakage. To overcome this difficulty cement-concrete tile are now being made where used. The owner of the farm is often fortunate enough to have an ample supply of sand and gravel,



Cement Tile Ready for Laying.

either on his own land or nearby. These two comprise the bulk of the materials used in the manufacture of concrete tile. For the smaller sizes it is not necessary to have gravel, as only Portland cement and sand are used.

A Portland cement of any standard brand will be suitable. The sand should be clean and coarse, with the particles well graded from fine up to $\frac{1}{4}$ inch in size. If gravel is used for very large pipes, it should be clean and also well graded in size, the pebbles running from $\frac{1}{4}$ inch to $\frac{3}{4}$ inch in diameter. When only cement and sand are used the concrete should be mixed in the proportion of 1 part Portland cement to $2\frac{1}{2}$ or 3 parts sand, measuring these materials by volume. For measuring purposes it is safe to assume that 1 bag of cement is one cubic foot. In very large sizes of pipe where gravel can be used, the concrete should be mixed in the proportion of 1 part Portland cement to 2 parts sand to 4 parts gravel. For most farmers a simple hand-mold for making pipe will be sufficient. These hand-molds are inexpensive and turn out pipe quite rapidly when properly operated. They are sold by the Besser Mfg. Co., 406 Fourteenth street, Alpena, Mich., and also by the W. E. Dunn Mfg. Co., 4139 Fillmore street, Chicago, and the Lansing Co., 747 Cedar street, Lansing, Mich. Write any of these companies for catalogs. The molds consist of two cylinders of sheet iron, one set within the other. The inside cylinder is collapsible and the outside cylinder can be removed in sections. When hand-molds are used it is good practice to make up the tile during the winter, doing the mixing and placing of the concrete indoors, where there will be no

danger of freezing. After the tile have become well hardened, say in about two weeks or one month, they can be placed outdoors until used. In this way the required number will be ready for laying by the time the frost is out of the ground.

Mixing the Concrete

The first requisite for the proper mixing of concrete is a well-made mixing board or platform. This platform should be made of boards carefully matched, in order that good tight joints will result. This will prevent any waste of cement and water from leaking through. A mixing platform 10 feet square will be large enough for all ordinary purposes. It is well to nail around the outside of the board a strip 1 inch in height, which will prevent the concrete from working over the edges. The tools necessary for mixing are generally at hand on all farms. They consist of shovels, rakes and hoes, and one or two water buckets. It is convenient to construct a bottomless measuring box for measuring the sand and gravel. The size of this box is determined by the proportions to be used. For a mixture of 1 part cement to 3 parts sand, the measuring box should contain 3 cubic feet. The sand and cement should be thoroughly mixed in the dry state, so that no streakings or unevenness of color can be seen. When this is accomplished the water should be added, taking care that too much is not applied at first. The mixture should then be turned and mixed until a paste of even consistency results. For use in tile work the concrete should not be too wet. It should be what is called dry mix. This dry mix is used so that the fresh concrete will hold its shape when the molds are removed.

Making the Pipe

Before starting to mix the concrete the molds should be set in place on a level and solidly supported board platform. In setting up the molds the directions contained in the printed matter accompanying them should be followed. The surfaces of the molds which come in contact with the concrete should be well



Cement Tile Stored in the Open. Freezing Weather Does Not Affect Them.

oiled with a heavy lubricating oil, which will prevent the fresh concrete from adhering to the iron. Deposit two or three inches of concrete in the molds and then commence the tamping. This tamping is accomplished by a long-handled tamper furnished with the molds, and so designed as to pass easily between the inner and outer mold. Continue depositing and tamping the concrete until the mold is full. Be careful

to fill the mold gradually. If half filled with concrete at the start and then tamped this will not result in a strong and uniform pipe. The tamping should be done continuously from the time the first concrete is deposited until the mold is full. When the concrete reaches the top it should be struck off to a smooth even surface with a trowel or float. As soon as it is deposited and tamping is completed the molds can be removed. In doing this care should be taken to avoid jarring the fresh concrete, as this might result in the collapse of the pipe.

Curing the Pipe

After the molds are removed the pipe should be allowed to rest undisturbed for 24 hours. They should then be kept wet by means of sprinkling or covering with burlap or rough cloth. Keep the covering moist. The pipe should not be allowed to dry out for at least one week. It will be found that this "curing" will add greatly to the strength and durability of the pipe. After thorough curing the pipe can be removed to the storage place. They should not be roughly handled, however, until one or two months of age. During the winter time it is best to protect the tile from freezing temperature until one month after making. Hand-moulds may be obtained for making either plain straight pipe or pipe with bell and spigot ends. Bell end pipe are somewhat more difficult to make. There are several machines on the market which run by power and which turn out tile in much larger quantities than can be done with the small hand-molds. They are manufactured by the W. E. Dunn Mfg. Co., 4139 Fillmore street, Chicago, and the Besser Mfg. Co., 406 Fourteenth street, Alpena, Mich. These machines are costly and would be necessary only where the quantity of pipe would be sufficiently large to warrant the necessary expenditure.

In conclusion, success in this undertaking, as in every other form of concrete construction, depends upon the selection of proper materials and careful and thorough workmanship.

THE CEMENT SHOW

Reports from the management of the Chicago Cement Show, to be held February 10 to 17, 1915, indicate that the prospects for a successful exhibition have never been more promising. Very wide interest is apparent among both exhibitors and the trade who make it a practice to attend these annual shows.

At the drawing for locations on August 8, four-fifths of the available floor space was assigned to over 100 manufacturers. Never before has there been such a large reservation of space so far in advance of the exhibition. Most of the concerns who have exhibited in the past shows will be found at the next exhibition. Many important manufacturers who have not participated in the show for several years have decided to go in again.

The Cement Show is clearly a growing institution. It seems to have become a permanent fixture of the cement industry. The opportunity of gathering annually with those in the concrete, building supplies and contracting industries is one which is enthusiastically welcomed by thousands. Many associations find it of advantage to hold their conventions each year in Chicago during the time of the big cement show. Important associations that have already fixed their dates during the cement show in Chicago are the National Builders' Supply Association, and the Illinois Lumber and Builders' Supply Dealers' Association.

The decorations and equipment for the cement show are now being designed along original lines.

HOW TO PATCH A CONCRETE FLOOR.

When a cement floor surface begins to wear it is often desirable to patch it. Leonard C. Wason, president of the Aberthaw Construction Company, Boston, in a recent paper, states the right way and the wrong way.

The Wrong Way.—Commonly a sand and cement mortar is made, some cutting is done and the mortar is put in and scrubbed with a steel trowel until smooth. It is then covered up for a while. If the concrete under the patch is left dry, it soaks up the water of the mortar. As a result, the mortar does not set. If the room is dry or hot, the surface of the patch dries out and for the same reason it does not set. If the concrete under the patch is dusty the patch does not adhere to the concrete. If the materials in the mortar are not suitable, naturally the patch wears badly, particularly as it is obviously located at a point of severe wear.

The Right Way.—Cut down the worn place at least one and a half inches. This cutting should be carried into the strong unbroken concrete and the edges should be cleanly undercut. The bottom of the cut should then be swept out, clean-blown out with compressed air or a pair of bellows, if available, then thoroughly wet and scrubbed with a broom. In this way, small loose particles of broken material which the chisel has driven into the surface are removed. A grout made of pure cement and water about the consistency of thin cream, should be scrubbed into the pores with a broom or brush, both at the bottom and sides of the cut. Following this a stiffer grout, about the consistency of soft putty, should be thoroughly compressed and worked into the surface, which has already been spread with grout. Finally, before the grout is set a mortar made of one part cement to one part crushed stone or gravel, consisting of graded sizes from $\frac{1}{2}$ inch down to the smallest excluding dust, should be thoroughly mixed and put in place, then floated to a proper surface. Cover with wet bagging, wet sand, sawdust, or other available material. All trucking should be kept off and the surface kept thoroughly wet for at least one week or ten days.

If a particularly hard surface is required, 6-penny nails are sometimes mixed with the mortar and other nails, stuck into the surface when the patch is finished. This will produce a surface which is extremely hard and durable.

BOOK REVIEW

Rock Excavating and Blasting

"Rock Excavating and Blasting," by J. J. Cosgrove, 5½x8½-inch, 180 pages, cloth bound, illustrated. A text book on the art of handling explosives—written to help the young engineer, superintendent, rockman or miner, to get the best results in various kinds of rock excavation. It is not an exposition of theories, but a compilation of useful information, instructions, definitions, tables, etc., which apply to actual practice. It is a subject that heretofore has been left for those who are new in the field to pick up for themselves. The book should fill a long-felt want. The titles of the chapters, which follow, should give a good idea of its contents: Force and Direction of a Blast; Sinking Shafts Through Rock; Tunnel Driving; Rock-Drilling Tools and Machinery; Operating Drilling Machines; Rock-Drill Bits of Steel; Hammer Drills; Stone Channelers; Powder; Charging Drill Holes with Powder; Dynamite; Method of Thawing Dynamite; Detonators for Exploding Charges; Firing Blasts by Electricity; Handling and Storing Explosives. For sale by the Excavating Engineer, 267 National avenue, Milwaukee, Wis., at \$2.50 per copy, postpaid.

The Plant of the Birdsboro Stone Company

The quarry of the Birdsboro Stone Company is located about two miles southwardly from Birdsboro, Pa. This has been equipped with every modern appliance for quarrying. The methods pursued have been such, that combined with the natural formation of the hill, the rock is shot out and loaded into the cars clean and free from foreign matter. By the use of machinery instead of hand labor, dependence is placed in a few high grade men rather than, as at most quarries, in the carelessness of a horde. The illustration herewith showing a portion of the quarry exhibits the methods of handling the stone. Large steam shovels, made by the Bucyrus Company of South Milwaukee, Wis., and also by the Marion Osgood Company of Marion, Ohio, are employed for loading the material. In drilling operations, the deep well method has been applied. The Keystone Driller Company, Beaver

ery has been installed for rapid loading from both plants. The track system is well laid out and the Birdsboro Stone Company handles its product with its own locomotives. All stone is weighed at the plant on scales under Pennsylvania Railroad supervision, so that there is no delay for weighing in railroad freight yards. All sizes are kept in stock and customers can be assured of shipments immediately on receipt of order at any season of the year. With these storage systems, accidents at quarry or crusher can have no effect on shipments.

The following physical, geological and chemical determinations shows the nature of

Birdsboro Trap Rock

and manifest the points in which it is superior to all other trap rocks, and the reason for it being the very highest grade material for all construction work.



Birdsboro Stone Co.'s Crushing Plant. 4,000 Tons Per Day Crushing Capacity. McCully Gyratory Crushers Used Exclusively, Furnished by the Power & Mining Mch. Co., Cudahy, Wis., and New York, N. Y.

Falls, Pa., furnished the drills, and they are giving good service. The quarry cars used were furnished by the Bellwood Car Company, Philadelphia. The Birdsboro Stone Company recently set off in one blast 6,600 pounds of dynamite, which dislodged 70,000 tons of rock. The dynamite was placed in 11 holes drilled 16 feet apart to a depth of from 40 to 90 feet. The shot cost \$1,500.

The crusher and screening plant is an example in every department of the most modern machinery and construction. The largest of the series of crushers will receive and crush a 12-ton block of stone, and is the only one of that size in use in any trap rock quarry. These crushers were furnished by the Power and Mining Machinery Company, Cudahy, Wis., and New York, N. Y. The screens are arranged in a manner that gives perfect satisfaction, and all conveying of the crushed stone is done on belts, thus eliminating unnecessary handling.

The plant has a daily capacity of four thousand tons.

The covered, and open storage facilities afford a total storage capacity of 250,000 tons. Adequate machin-

These determinations were made by Hon. L. W. Page, Director, Division of Tests, Office of Public Roads, United States Department of Agriculture, Washington, D. C.

Determinations.

Specific gravity	2.95
Weight per cubic foot (solid stone).....	184. lbs.
Water absorbed, per cubic foot.....	.14
Per cent of wear	2.0
French coefficient of wear.....	20.0
Hardness	18.
Toughness.....	26.
Cementing value	Good

Remarks: This is a hard rock, with high toughness and resistance to wear, and good cementing value. Should make an excellent road material.

Essential Materials.

Name.	Composition.	Per Ct.
Plagioclase.	Silicate of Alumina, Lime and Soda.	41.2
Augite.....	Silicate of Lime, Magnesia, Iron and Alumina	39.9

Accessory Minerals.

Name.	Composition.	Per Ct.
Magnetite....	Magnetic Oxide of Iron.....	4.6
Olivine.....	Silicate of Magnesia and Iron.....	0.7

Secondary Minerals.

Serpentine...	Hydrous Silicate of Magnesia and Iron	3.2
Chlorite.....	Hydrous Silicate of Magnesia, Iron and Alumina	4.1
Kaolin.....	Hydrous Silicate of Alumina.....	6.3
Total per cent.....		100.0

Remarks: Specimen is a dark gray, coarse-grained diabase, composed essentially of somewhat kaolinized plagioclas (labradorite) and chlorized augite.

To these tests is supplemented the following averages of several tests made by the Consulting Geologist to the Commonwealth of Pennsylvania:

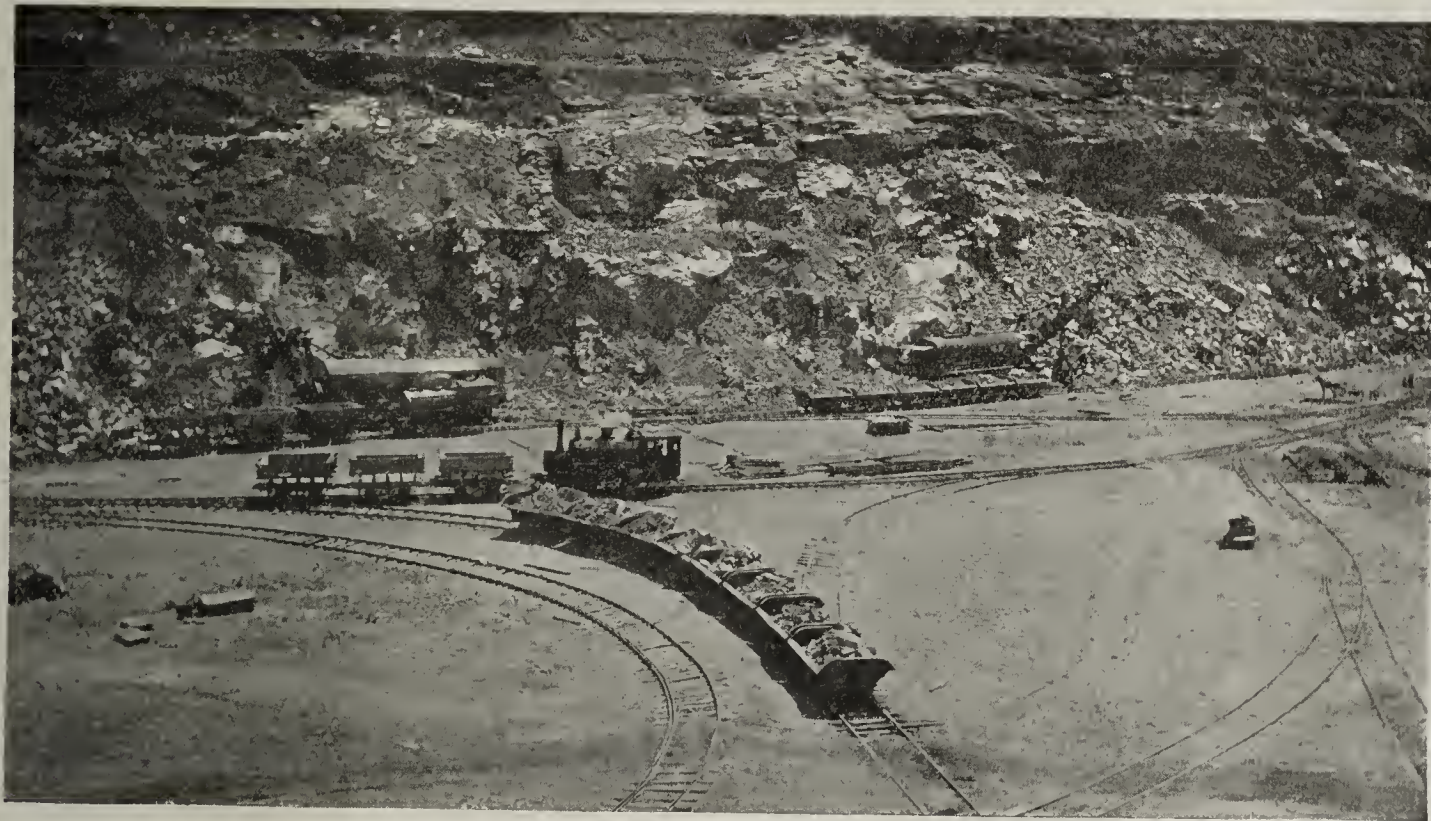
Hardness of Rock according to Mohs Scale.....6.7
Crushing resistance per square inch, over...20,000 lbs.

In viewing these reports attention is especially called to the high record figure in the report on **toughness**, the most important item.

The low percentage in water absorption is also to be noted. This is .6 lower than the same tests show on the stone of nearest competitor.

CRACKING IN CONCRETE ROADS

Probably more criticism of concrete pavements is centered on the cracks which occur than upon any other features of this kind of construction. A. N. Johnson, state highway engineer of Illinois, in a paper before the American Road Congress attributed the formation of cracks to unequal settlements of the subgrade, supplemented by external stress due to the passage of heavy traffic or to the movement of the slab under temperature changes. In commenting upon this, Henry S. Spackman refers to experiments conducted by him which showed that when concrete is mixed as wet as it generally is in modern road work it shrinks during the first twenty-four hours and then expands during the next three or four months, the shrinkage being undoubtedly due to a draining out of the water and the expansion to the continuation of the chemical action, which continues for months and even for years in a continually lessening degree. In view of this shrinking which begins almost as soon as the concrete is laid, it seemed impossible to prevent the cracking of the pavements unless the exudation could be prevented. Mr. Spackman has experimented with the addition of hydrated lime for this purpose, and compared eighteen test pieces to which hydrated



Birdsboro Stone Company's Quarry. Modern Equipment Used for Drilling and Loading Crushed Rock. In One Blast Recently Fired in This Quarry 70,000 Tons of Rock was Dislodged; 6,600 Pounds of Trojan Powder Was Used With Remarkable Success.

It is also of interest that attention be drawn to the fact that the crushing resistance is greater by 2,000 pounds per square inch than same tests on stone of nearest competitor.

NEW GOOD ROADS BOOK.

The 1914 Good Roads Year Book, published by the American Highway Association, is now ready. It is cloth bound, contains about 500 pages, and costs \$1. Sent on receipt of price by CEMENT AND ENGINEERING NEWS, Schiller Building, Chicago. It contains a statement of the funds available for road improvement in all states and the appropriations by state legislatures. Other information contained includes lists of patents relative to roads and bridges; expenditures in recent years; work of associations; methods of construction; materials; directory of bulletins and documents; description of dust preventives; summary of road laws; specifications; events in road movement of 1913; road systems in foreign countries.

lime had been added to the extent of 10 per cent of the amount of cement in some instances and 20 per cent in others, and nine test pieces containing no lime. During the first twenty-four hours the average contraction for those containing hydrated lime was .007 per cent, as against .015 per cent for the pieces containing no hydrated lime. At his suggestion also the Office of Public Roads laid a short stretch of road at Chevy Chase, Washington, D. C., using hydrated lime, and another was laid near Salisbury, Md. These experiments all lead him to believe that the addition of 10 to 15 per cent of hydrated lime will be found beneficial not only in reducing cracks, but also in eliminating the formation of holes and soft spots. Such addition, he says, not only causes the mortar to hold the water, but the more plastic and viscous mortar eliminates the segregation of the cement from the sand and secures a more homogeneous mixture, lessening the liability of pockets of material deficient in cement.

SILAGE-SECURITY

By Homer T. Genung*

The American farmer found out some time ago that his profits are greatly increased when he raises stock, for he then fattens his own bank balance with margins that usually buy luxuries for middlemen and railroad magnates. The farmer-stockman keeps for himself the earnings of the grain dealer, the railroad company and the stock seller. He does away with numerous costly transfers of food and cattle, and he saves on each transfer that he renders unnecessary.

Once the certainty of profit in stock raising was established, the question of an assured food supply became vital. The stockman started to find a food

supply that could be economically stored, and that would tide over long drouths, and bad seasons. It was necessary to the success of his business that a failure, or threatened failure of crops should not force him to sell his cattle in the time of low and ruinous prices. It was necessary to his peace of mind that he know that the food for his cattle was secure—absolutely SECURE. So the question resolved itself into a search for economical and SECURE STORAGE.

The silo solved this problem. Besides, it did a great deal more. It showed the farmer that he could increase the efficiency of his cornfield 66 2-3 per cent by conserving the nutriment in the stalks and husks and leaves. It showed him that he could store the 100 per cent food value in a safer and more economical space than was required for the customary 60 percent. It hinted to him that prosperity comes to the man who CANS HIS CORNFIELD. Some farmers were slow to see, and a few there are who have not seen, but the majority accepted the silo gladly and have kept it still more gladly.

Today it isn't a question of silo or no silo. There is only one question left, and although some people don't think so, even that has been solved. This question relates to the kind of silo—the material, the design, and the construction.

Do you remember that SECURE Storage is what the farmer was hunting for? Don't you know that he does not want to wrap up a big sum of money in a herd of cattle and then take the chance of having to sell them at a loss when a drouth comes, or when the fire demon or tornado calls on him? Don't you know that a WISE FARMER won't put away a six months valuable food supply in a tall, self-supporting cylinder without seeing to it that that cylinder is so constructed that it renders that food supply absolutely SECURE?

Mr. Farmer does not intend that his silage be liable to destruction by WIND or FIRE. He doesn't want his silo to go gallivanting across the country with the first rakish breeze that blows along. He does not want it to burn if his barn does. He wants to save that food supply (and his business) no matter what happens. He puts his silage in a WINDPROOF, rat-proof, burstproof, FIREPROOF, warpproof, crack-proof, LIGHTNINGPROOF SILO. He builds the silo that has stood up under the attacks of wind, fire, and lightning. The WISE FARMER builds a POLK SYSTEM MONOLITHIC CONCRETE SILO and rests SECURE.

CONCRETE IN HIGHWAY CONSTRUCTION

A new book entitled "Concrete in Highway Construction," has just been published—136 pages and cover, 6½x8¾ inches, illustrated. Price \$1.00. Atlas Portland Cement Company, 30 Broad street, New York are the publishers.

A text book for highway engineers and supervisors containing a detailed treatise on the various uses of concrete in highway construction. It is divided into the following chapters: One, Concrete; Two, Sidewalks, curbs and gutters; Three, Street Pavements; Four, Sewers, drain piles, brook linings and conduits; Five, Culverts; Six, Beam bridges; Seven, Arch bridges; Eight, Retaining wall; Nine, Miscellaneous, fence posts, hitching posts, lamp posts, drinking fountains, etc. The book is well written, containing numerous and useful tables, sketches and photographs of use to engineers or any one interested in highway construction. Mention Cement & Engineering News when writing.

*Sec'y. Polk-Genung-Polk Co., builders of Reinforced Monolithic Concrete Silo forms.



H. H. Brownell & Co. recently completed this silo-tank of the "Polk" system for W. R. Brumfield of Hopkinsville, Ky., 12 feet in diameter by 63 feet high. The floor is 18 inches thick and walls 6 inches. The capacity of tank is 25,380 gallons, which it is claimed is the largest capacity tank on silo in the United States, and the structure was made absolutely waterproof by the use of Medusa Waterproofing. The forms for making this monolithic concrete silo and water tank were made by Polk-Genung-Polk Co., Fort Branch, Ind.

A GRAVEL PLANT WITH SEPARATE CONCRETE BINS

The Norfolk Sand & Gravel Corporation of Norfolk, Virginia, has a 500-yard sand and gravel washing and screening plant. This plant is a model of its kind

and is perfectly equipped to produce the highest grade of washed sand and gravel. This plant is located within the best residence district of Norfolk, at the mouth of Tanner's Creek, about 250 feet from the James river. The plant, however, is not unsightly and the grounds and office buildings are carefully planned, and as the power is supplied by electric motors little noise is produced.



General View of the Plant, Showing Concrete Storage Bins.

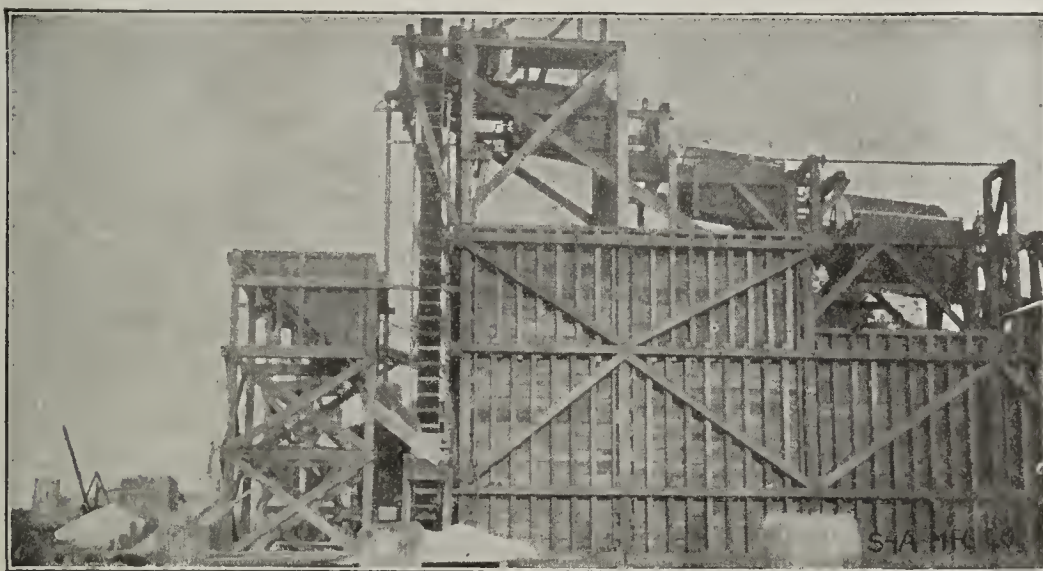
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8x11 $\frac{3}{4}$ -inch elevator buckets.

The standard arrangement of screens is used and the material is thus washed and separated into the following sizes: Sand, grits, roofing gravel, and that passing a one-inch mesh. This is discharged from the screens into the bins below, graded according to the various sizes.

The concrete storage bins are located about 200 feet



View of Screening Plant, Showing Receiving Hopper.

In general arrangement, the plant consists of the main screening plant, below which are storage bins for the various sizes of material. In addition to this storage there has been constructed a concrete storage bin, divided into six compartments, of seventy-five

cubic yards capacity each, which is connected to the screening plant by a belt conveyor. A short inclined piling conveyor also provides additional sand storage in a pile near the river.



General View of the Plant.

The material is brought to the plant on barges from the Potomac river and Virginia beach. A loco-

motive crane, equipped with a clam-shell bucket, unloads the material into a hopper from which it is elevated by a continuous bucket elevator, and raised to the screens. This elevator is thirty-two feet between centers and is equipped with Style No. 21, 16x

drawn out onto the conveyor. Beyond the screening plant the conveyor rises on an incline until it reaches a point above the concrete bins where it returns to the horizontal and passes over the bins.

A hand-propelled tripper operates on a track above the bins and it is thus arranged that material from

any bin below the screening plant may be delivered to the compartment in the storage bin, used for the same size material.

The storage bin is designed so that teams may drive beneath any part and by means of gates, which may be operated from the driver's seat, the wagons are instantly loaded with the desired grade of gravel or sand. As the long storage conveyor returns to the horizontal about 100 feet from the bins, it has been possible to extend the tripper out along this part of the conveyor and thus utilize the space below the trestle for emergency storage.

The surplus sand is carried from the plant by an 18-inch belt conveyor, 70 feet centers, to a pile near the river within reach of the locomotive crane. In this way, the sand may be reloaded onto barges on the river and thus delivered by gasoline tugs and barges to various parts of the city, to Hampton Roads and the nearby smaller towns.

The particular feature of interest in this plant is the separate concrete storage bin. Under this arrangement, the bins beneath the screening plant may be relatively small and as they do not need to be elevated above the team tracks, the screening plant proper is very low. This is of particular advantage as it thus becomes unnecessary to support the machinery at an excessive height.

This arrangement of storage bins also allows greater flexibility and allows an excess accumulation of any special grade when it is of advantage to hold it; or it is possible to bypass some of the material delivered to the plant, which does not require screening, delivering it direct from the receiving hopper to the storage conveyor and thence into any one of the compartments reserved for the purpose.

The emergency storage space below the conveyor trestle is another advantage, not possible where the screens are placed above the bins and where it is only possible to store a limited amount of each size.

This arrangement is, of course, not suitable under all conditions, but it has been found most advantageous here, and it is probable that it may be adapted to other plants where the material to be screened is delivered from a distance and where supply and demand are more relatively constant.

SILAGE KEEPS FOURTEEN YEARS

On the farm of Mr. O. W. Righter in Indiana is a home-made monolithic concrete silo fourteen years old. Mr. Righter himself built the silo with home-made wood forms. It has a total height of fifty feet, five feet of which is below the ground. The walls at the ground line are eighteen inches thick and the clay bottom is kettle shaped.

Mr. Righter asserts and confirms by affidavit that the silo was never emptied below the ground line until July 1914. This summer need for all of the silage was occasioned. The owner was in doubt as to the condition in which he would find the silage at the bottom. With the exception of a slightly increased acidity the difference between it and the fresher silage was not noticeable. The cattle ate it with no less relish than common.

The corn from which this silage was made came from a fifty bushel an acre yield. It was ripe when put into the silo. A sample of this fourteen-year-old product was taken from the center of the silo within three inches of the bottom by a representative of the Polk Genung Polk Company of Fort Branch, Indiana, manufacturers of the Polk system forms for building monolithic concrete silos. It is being preserved in alcohol and used for demonstration purposes.

A CONCRETE BLOCK GRAIN ELEVATOR.

The McKenzie Cereal Food & Milling Company, of Quincy, Michigan, has designed and built a concrete block elevator of considerable interest, with a total capacity of 75,000 bushels. There are four circular bins, 15½ feet in diameter, and eight smaller bins of various sizes. The over-all dimensions, exclusive of the working house at one end, are 40x46x70 feet high.

The walls are of concrete blocks, 8x12x24 inches in size, with a double air space. The block is shown herewith. The two outer air spaces are intended for heat insulation, and with the adjacent horizontal grooves, which are not filled with cement mortar when the blocks are laid, give a vertical air space 2½x6 inches, and horizontal air spaces 1x2 inches, continuous in both directions. The openings at the back of the block are intended to receive vertical reinforcing steel and to be poured full of concrete. When the blocks are laid up there is an additional opening between blocks, a circle 3½ inches in diameter, which is also filled with concrete, forming a key. When the horizontal reinforcement is placed in the back groove, the rings are completely embedded. Both vertical and horizontal reinforcement consists of ½-inch twisted steel rods. Horizontal rings are lapped 42 inches, and the laps are staggered.



Blocks Used in the McKenzie Elevator.

This gives a wall having all the advantages of monolithic concrete, practically a reinforced concrete 8-inch wall, with an outer shell separated from the inner by over 60 per cent of air space. Mill hands made all the blocks and the entire construction was handled by the owner.

The purpose of the air space was to permit the circulation of warm dry air throughout the wall. The elevator is intended for the storage of buckwheat, for making self-rising pancake flour and considerable care is necessary in storing. The moisture content and temperature have to be watched very carefully and a heating system is essential to safe storage. When the walls were complete, but before the cornice was added, a fire was built in the basement, which opened into all the vertical air spaces. Smoke was evident coming from every air space in the upper course, 70 feet above.

The owner knew the value of wet, dense concrete. The blocks do not absorb moisture, and while they are of the "rock face" type, which is ordinarily to be condemned for general building, yet in the elevator, with its areas of large extent, it is probable that this was a fortunate choice. The elevator is now surmounted by a working house and presents an excellent appearance.

Michigan Lime Stone & Chemical Co., Calcite, Michigan, is busy remodeling and increasing the output of their plant. They have four large shovels in operation, the two newest being 95-C Bucyrus, which are giving them excellent satisfaction. This company crush their rock and load directly into vessels at their wharf. They anticipate a larger output this year than ever before.

HYDRATED LIME

Seldom has a material been given the unqualified endorsement of the United States Government in such an unequivocal manner as was set forth in the conclusions reached by the United States Bureau of Standards after a long series of tests to determine the best waterproofing materials. These tests were made with forty different compounds, presumably all the waterproofing materials known to the United States government at that time. Results of these tests were printed in a report of 127 pages, and can be secured by writing for report No. 3 to the U. S. Bureau of Standards at Washington, D. C. Mixture No. 27-B was one in which 10% of HYDRATED LIME was added to the cement. On page 59 in the report you will find the results of this test described as follows:

"This is the most efficient medium employed and resulted in an almost impermeable mortar at the two week test. Its value is probably due to its void filling properties.

Uncle Sam has further endorsed and standardized LIMOID (the trade name of the hydrated lime made by the Charles Warner Company of Wilmington, Delaware), as will be noted from the Government's specifications issued from the War Department, reading as follows:

"Mortar—All brick work is to be laid in mortar composed of one part cement and three parts sand, with the addition of 10 pounds of hydrated lime to each bag of cement used. The materials are to be thoroughly mixed dry and wet to the proper consistency immediately before using. No retempering will be allowed."

"Lime shall be hydrated, equal in quality to 'LIMOID'."

As a result of this endorsement the purchasing department of the Isthmian Canal Commission which buys all the supplies used on the Panama Canal, placed orders with the Charles Warner Company for 250 tons of LIMOID to be used as follows, according to a letter of Mr. C. E. Dole.

"Please be advised that we are using LIMOID to temper mortar for brick masons in laying the hollow concrete blocks and brick work on all of the permanent buildings now under construction, and will also use it for tempering the stucco to be applied to these buildings. The structures on which LIMOID is being used include the Administration Building, the four transmission line substations, the hydro-electric station, and twenty-four family quarters for employees."

Why does the U. S. Government specify LIMOID in concrete cement mortars? Because it is the Standard Hydrated Lime. It has been made the standard because of its uniformity and general excellence, its absolute purity and dependability. LIMOID is made under the most rigid mill control and direct chemical supervision. The following from a report of the H. S. Spackman Engineering Company is self-explanatory:

"From our frequent observations made during the past year, we are well satisfied that the rigid chemical control installed in the manufacture of LIMOID at your Cedar Hollow plant is thorough and effective.

"A study of these conditions shows that LIMOID has contained no free or unhydrated calcium oxide at any time since the installation of this complete control method and has averaged an excess of 1.25% of water over the amount necessary for complete hydration."

Why does the U. S. Government use LIMOID (Warner's Hydrated Lime)? Because the most

prominent engineers and contractors have adopted as standard practice the mixing of hydrated lime in cement mortars for the reason that it not only increases plasticity and decreases shrinkage, but it renders mortars and concretes watertight and gives them a uniform color. It not only carries more sand, but on account of its plasticity and ease of working, makes a smoother and better joint and men lay more brick and do better work with less effort.

From an economical standpoint it does away with the labor and dirt and the space for a curing bed. It can be machine mixed and is always ready for use. It not only does away with the cost of slaking but being hydrated by a chemical process and by uniform and unvarying methods it eliminates all possible chance of unslaked lime and therefore the danger of popping and butterflies in plastering. This last feature might well be called a quality element, since the method of manufacture employed by Charles Warner Company absolutely eliminates any impurities, core or grit, as well as any incompletely hydrated particles. [The Mason Builder].

REINFORCED CONCRETE PRESSURE PIPE

One of the interesting events connected with the recent meeting of the American Society of Civil Engineers in Baltimore was found in the demonstration test of the immense reinforced concrete pressure pipes of the Lock Joint Pipe Co., 165 Broadway, N.Y., for the Baltimore water supply system. The contract amounts to \$226,000, including installing the pipes, and was awarded after careful consideration by City Water Engineer Ezra Whitman. President Coleman Meriwether, the inventor of this system was present, and a number of other members of the society witnessed the tests with a great deal of interest. This is the first large installation of this system where the concrete pipes are required to be under pressure. The pressure which it will be under when installed is 35 pounds per square inch, but in this test the pressure was carried to 70 pounds and continued at that point for several days after the demonstration.

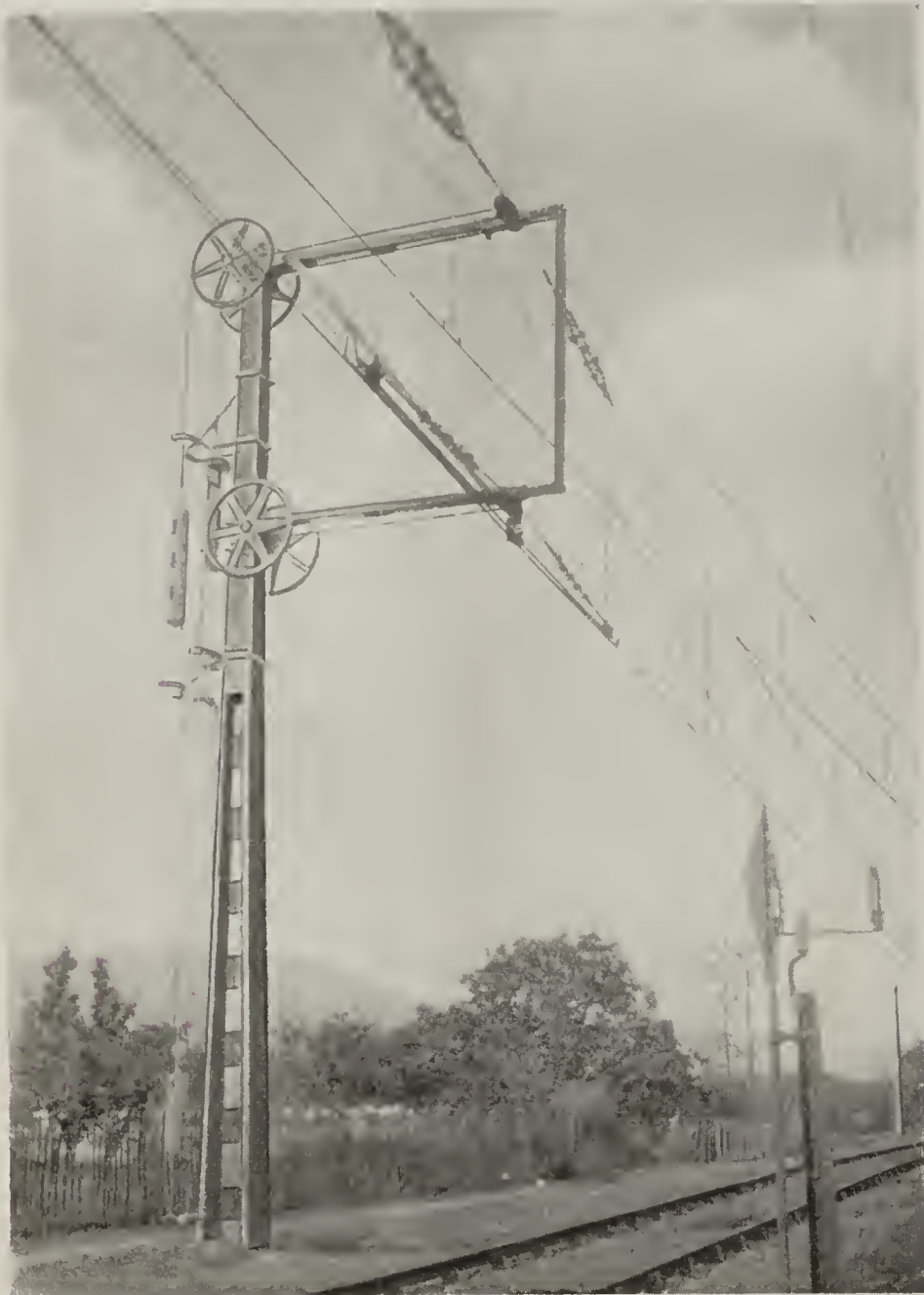
There are two sizes required for this contract, 108 inches in diameter, 9-inch shell, and 84 inches diameter, 8-inch shell, each 6 feet long, and the sections weigh 10½ tons and 7¼ tons, respectively.

The tunnel in which the pipes are to be placed is the old water tunnel built in 1871. It is 12 feet in diameter, and an ingenious hauling equipment has been constructed by Superintendent Mitchell, in charge of the work for placing the heavy pipe sections, having only 9 inches clearance in the tunnel. They must be hauled considerable distances, as the pipe is laid from the middle toward each end of the tunnel, where the openings are located, 4200 feet apart, for admitting the sections. The total length of the piping of both sizes in the tunnel is 5365 feet, and in open trench 2560 feet. A small drainage system for carrying off ground water is constructed under the piping. The reinforcing material for this work is furnished by the American Steel & Wire Co., of New York, and the Corrugated Bar Co., Buffalo, N. Y.; the cement by the Dexter Portland Cement Co., Nazareth, Pa., and the sand and gravel by the Arundel Sand & Gravel Co., Baltimore, Md. The hauling of this sand and gravel was economically and rapidly carried on by motor trucks.

While engaged in the big Baltimore city contract, the Lock Joint Pipe Co. is making still longer and heavier sections of its pipe in 15-foot lengths, 108 inches diameter, for the Consolidated Gas, Electric Light & Power Co., of Baltimore, for its Westport plant water conduits.

REINFORCED CONCRETE POLES PROVE SATISFACTORY IN ALL CASES

Engineers, contractors, concrete product manufacturers and dealers in cement, whether in cities or small towns, will find it profitable to urge the use of their material in the construction of reinforced concrete poles, especially to representatives of railroads or those connected with telephone, telegraph, and electric companies. As a matter of fact, many corporations using poles are now turning to reinforced



Concrete Poles on the Midi Railroad, in France.

concrete as an economical substitute for wood, notably such great railroads as the Pennsylvania, which is manufacturing its own poles. This company has good reason to abandon the wooden pole. The use of wooden poles on the New York Division of the Pennsylvania Railroad cost the company \$118,400 in the form of repairs to their line after the great blizzard of last March. Wooden poles were snapped off like pipe-stems, and the entire line went out of commission for a number of days, involving very extensive repairs. On the Hackensack Meadows, the very center of the storm, the company has a long line of reinforced concrete poles, which emerged from the test intact. So violent was the wind and so great the accumulation of snow and ice that the wooden cross-arms on these poles were broken down, but the poles themselves withstood the stress, not one being broken.

This is the record of reinforced concrete poles wherever they have been used. They are made of Portland cement concrete reinforced with steel rods to take care of tensile strains, and as concrete improves with age and exposure to the elements, the poles

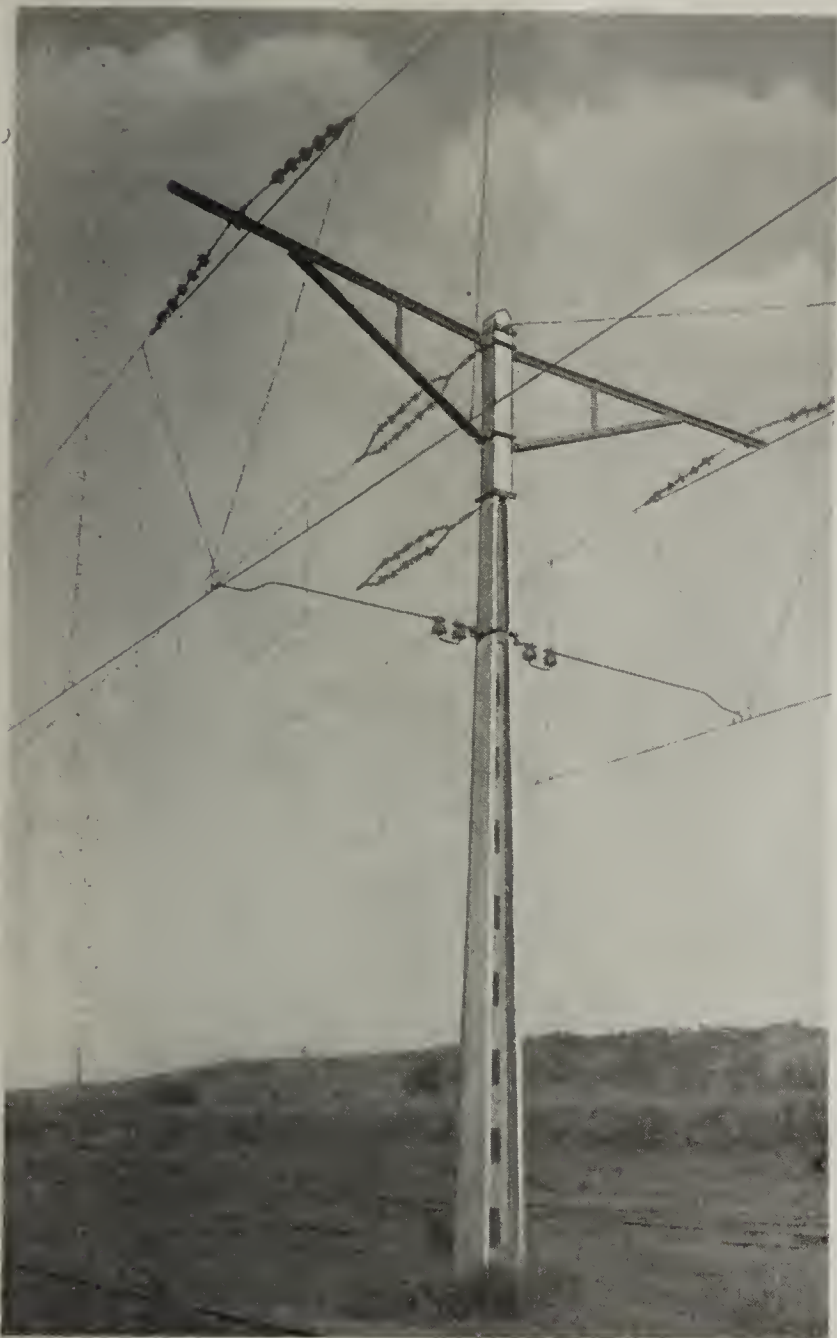
are constantly gaining in strength and durability. They keep in perfect alignment and never rust or rot, as is the case with steel and wooden poles. At the present price of timber they are a cheap investment. An illustration on another page shows how the reinforced concrete pole idea has extended to lighting standards of both ornamental and useful character. The illustrations are in sharp contrast to the unattractive poles of wood now encumbering the streets of many small towns and cities. Lighting standards and poles of the type shown immediately win public favor. People are glad to have a lighting standard or pole on their premises when made in the attractive form of that shown in the picture.

As stated above, wooden poles are constantly increasing in price. Even when much more plentiful, the short life of the wooden pole made it far from economical, and no effort was made to prolong their usefulness by treating them with preservative compounds. Their duration depends in a great measure upon the nature of the soil in which they are planted. In some soils they decay very rapidly. The point of decay at the ground line is produced by alternate wetting and drying. At this point the wood frays, and, when on a grassy right-of-way, is in danger of further destruction by fire. This was especially the case when coal-tar was used as a preservative. Thus the preservation of timber poles has done little to remedy the situation.



Before the reinforced concrete pole was invented experiments were conducted with metal poles. The steel pole proved to be not only expensive, but required constant outlay for maintenance, as it is subject to corrosion.

In the case of reinforced concrete poles, the steel is kept in a state of perfect preservation, and the life of a pole of this character is practically indefinite. As the result of a long series of experiments they are now entirely satisfactory, this having been demonstrated by severe practical tests of the character described above. As in the case of steel poles, they can be spaced greater distances than is economically possible with wooden poles, and they possess fire-resisting qualities equal to steel. They are pleasing in color, and may be easily modified in outline to suit



the locality in which they are to be used. By the insertion of pipes, wires may be carried from the top of the pole to the ground, and thence in any desired direction. On long or important transmission lines, where reliability of service is especially important, the additional expense of the reinforced concrete pole is fully warranted.

HYDRATED LIME

When the Equitable building is finished, it will be the largest office building in New York City, and this practically means the world, since nowhere else on the face of the globe are there such immense structures devoted to offices. The prime cost of the building, some \$29,000,000, gives a real estate assessment which might well cause envy in the breasts of a majority of smaller municipalities of the country.

It is interesting to know that in the construction of this great building by the Thompson-Starrett Company there will be used 4,000 tons of hydrate lime in the cement mortars for making them plastic and waterproof, furnished by the Charles Warner Company of Wilmington, Delaware.

REINFORCED CONCRETE

The Hill Book Company has recently issued a volume by Prof. G. A. Hool of the University of Wisconsin on the general subject of "Reinforced Concrete Construction." This is Volume I of a series of three volumes on the subject, the sub-title of this particular volume being "Fundamental Principles." Prof. Hool is connected with the Extension Division of the University of Wisconsin and this volume was prepared especially for use in the work of that department.

The second volume of the series will be on the detailed design of retaining walls and Reinforced Concrete buildings, and the third one on concrete bridges and miscellaneous structures. The second volume will contain 666 pages and will cost \$5.00. It will be out on August 10th.

It has, as suggested, been prepared especially to meet the needs of those who desire to take up the study of the subject by correspondence, but the author sees no reason why it may not be employed for other purposes. It takes up in the first place the general properties of materials which enter into concrete and secondly the theory and design of slabs, beams and columns. The volume is fully illustrated and is supplemented by a number of tables which will be found of much value. It is published in loose leaf form, as well as in regular book form. The price is \$2.50. Sent on receipt of price by CEMENT AND ENGINEERING NEWS, 1117 Schiller Bldg, Chicago, Ill.

SAND COMPANIES TO GIVE BOND.

Sand dealers in Kansas who have taken the constitutionality of the state sand royalty law into the federal court will have to make monthly reports to the court and put up bond to cover the amount they will have to pay the state if they lose their suit. John S. Dawson, attorney general, yesterday obtained an order to that effect from John C. Pollock, sitting at Kansas City.

The order applies to the Jackson-Walker Coal Company, which brought the suit in the federal court to restrain the state officers from collecting the royalty provided for by the 1913 legislature. It also takes in the Arkansas City Sand Company, the Arkansas River Sand Company and the Schwartz Sand Company of Wichita, who made themselves parties to the Jackson-Walker Company proceedings. The Jackson-Walker royalties, it is estimated, will run about \$800 a year.



Concrete Poles in France.

SAND AND GRAVEL

By Ralph W. Stone

The total production of sand and gravel in the United States in 1913 reported directly to the United States Geological Survey was 79,555,849 short tons, valued at \$24,217,508, a net increase in quantity of 11,201,286 short tons and in value of \$1,104,300 over the production of 1912. Sand for building purposes constituted nearly one-third of the total production. In 1913 a production of 25,397,383 tons of building sand was recorded with a value of \$8,007,949. This is an increase in quantity of 1,621,370 tons and in value of \$39,822 over the production of 1912. The average value per ton, which increased from 31 cents in 1911 to 33½ cents in 1912, fell to 31½ cents in 1913.

Value of sand and gravel produced in the United States, 1904-1913:

Years	Value
1904	\$ 5,748,099
1905	11,223,645
1906	12,698,208
1907	14,492,069
1908	13,270,032
1909	18,336,990
1910	21,037,630
1911	21,158,583
1912	23,113,208
1913	24,217,508

The following table gives the total production of glass sand in the United States in each of the last 10 years:

Quantity of glass sand produced in the United States, 1904-1913, in short tons:

Years	Quantity
1904	858,719
1905	1,060,334
1906	1,089,430
1907	1,187,296
1908	1,093,553
1909	1,104,000
1910	1,461,089
1911	1,538,666
1912	1,465,386
1913	1,791,800

The following table gives the production of molding sand in the United States in each of the last 10 years, or since 1904, when the first statistics of molding sand were collected:

Value of molding sand produced in the United States, 1904-1913, in short tons:

Years	Value
1904	\$2,125,370
1905	2,102,423
1906	2,063,151
1907	2,460,754
1908	1,342,802
1909	2,146,220
1910	2,431,254
1911	2,132,469
1912	2,718,726
1913	2,230,217

The production of gravel exceeded that of building sand by more than 13,000,000 tons. The total production of gravel in 1913 was 38,526,498 tons, valued at \$8,842,811, or an increase in quantity of 8,754,913 tons and in value of \$1,101,794 over the production of 1912. These figures show an average cost per ton of slightly less than 23 cents, or 3 cents less than the average value per ton of gravel in 1912. This large quantity of gravel was used for many

purposes, including concrete, paving, filter beds, roofing, road making, and railroad ballast.

Molding sand, which in 1912 for the first time exceeded a production of 4,000,000 tons, seems to have had a severe setback in 1913, if the returns are as complete as in 1912. The production of molding sand reported for 1913 is 3,563,583 tons, valued at \$2,230,217, a decrease in quantity of 921,797 tons, and in value of \$488,509 from the production of 1912. Although New Jersey made a good increase in production, there was a very large decrease in Illinois, Indiana, Michigan, New York, Ohio, and West Virginia. Thus the depression in the iron and steel trades shows itself, or an overproduction in 1912 is counterbalanced.

Glass sand, on the contrary, was marketed in greater quantity than ever, the total quantity produced in 1913 being 1,791,800 tons, valued at \$1,895,991. This is an increase in quantity of 326,414 tons and in value of \$465,520 over the production of 1912. The average value per ton rose from 97 cents in 1912 to \$1.05 in 1913. The revision of the tariff on glass seems to have had no effect on the production of glass sand, if we may judge by the quantity reported sold.

Grinding and polishing sand fell off 344,490 tons from the production of 1912, in which year the production exceeded that of 1911 by 347,235 tons. The value of the product in 1913 was \$540,399, or \$91,737 less than in 1912.

The production of fire and furnace sand remained practically the same, totalling about 519,000 tons, and the output of engine sand reported was about 255,000 tons less than in 1912.

Paving sand production nearly doubled in quantity in 1913. The production reported was 3,335,508 tons, valued at \$1,020,389, as compared with 1,788,530 short tons, valued at \$670,680 in 1912, an increase in quantity of 1,546,978 tons and in value of \$349,709.

Railroad ballast sand is this year separately recorded for the first time. The reported production of 2,335,196 short tons, valued at \$266,852, is not the total quantity of sand ballast used by the railroads in the United States in 1913, for the reason that some railroads keep no record of the quantity of sand produced and used by them in making cuts and ballasting their road beds, it being with them only a matter of moving material from one point on the right of way to another point. The quantity and value given above were actually reported.

The entire report of the production of sand and gravel is necessarily incomplete because it is impracticable to attempt to get or to estimate the quantity of sand produced by the thousands of individuals who each year dig a small quantity for their own use. This production, of which there is no count or accounting, may average less than a ton for the individual producer, but the aggregate may be hundreds of thousands of tons. The figures each succeeding year should be nearer the actual production, as the list of producers is added to annually.

The gravel figures for 1913 do not include a considerable quantity of chats or tailings from the Missouri zinc mines. The production of chats in Missouri and Kansas in 1913 was 2,028,889 tons, valued at \$304,333. The gravel figures do include 125,897 tons of chert, valued at \$52,883, used for road building in Alabama.

The unit of measurement given in the tables of production is the short ton. Much of the sand is reported as sold by the cubic yard, a cubic yard varying in weight from 2,300 to 3,000 pounds, according to the condition of the sand, according to the ma-

terial of which the gravel is composed, and according to the custom of the locality. All of the glass sand is sold by the short ton, and also a considerable quantity of the molding, building, and other sand; hence the quantities reported were all reduced to this unit.

Imports

Sand valued at \$172,257 was imported into the United States in 1913, as compared with imports valued at \$141,690 in 1912 and at \$147,268 in 1911. This is largely building sand brought to the United States as ballast, or from Canada as a near source of supply, but it includes a small quantity of French molding sand which comes to this country barreled in lump and is here ground and pulverized before marketing.

Sand for Steel Molding

The principal requirement of a sand for steel molding is a high degree of refractoriness, and therefore clean quartz sand containing more than 95 per cent silica is used. The size of the grain demanded varies

NEW BOOK.

The Properties and Design of Reinforced Concrete is the title of a new book, translated and abridged by Nathaniel Martin, civil engineer, and lecturer of reinforced concrete, Royal Technical College, Glasgow. It contains the instructions, authorized methods of calculation, experimental results and reports by the French government commissions on reinforced concrete. Reinforced concrete had its origin in France. French constructors were accumulating experience of its properties, and research was being carried on by French engineers many years before the material came to be regarded as a practical proposition in other countries. Consequently, the commission appointed in December, 1900, by the French Minister of Public Works, embraced a group of engineers whose experience in this material was unrivaled. The work of this commission, extending over the succeeding six years, included a series of experiments, simple in detail and comprehensive in range, and directed not to the solution of academical minutiae, but to the obtaining of



A View of a Small Part of the Quarry of the Wagner Stone Co., of Sandusky, Ohio, at Castalia, Ohio, Where Tripod Air Drills Have Been Discarded and Five No. 2 Gasoline and Electric Power "Clipper" Deep Well Drills Put in Their Place—Two of Them Showing in Above Cut. Model 75 Marion Shovel Employed for Digging and Loading Crushed Stone.

with the weight of the casting and the place occupied in the mold. Steel molding sands are commonly white but may be yellow or light brown.

STONE QUARRY NEWS

The Holran Stone Co., Maple Grove, Ohio, operate a 18-B Bucyrus steam shovel in their quarry.

The Illinois Stone Company use a steam shovel in their quarry at Lemont, Ill., for loading crushing stone.

Two million pounds of stone were displaced in the quarry of the Lehigh Portland Cement Company at Mitchell, Ind., when dynamite in sixty 6-inch well holes in the face of the quarry was exploded. The charge was set off by an electric current. The town of Mitchell, a mile and a half distant, was shaken by the violence of the explosion.

results immediately applicable to practice. The report of the commission contains the results of the tests on experimental structures and of the tests to destruction of several of the structures of the Paris Exhibition of 1900. It is unique in the literature of reinforced concrete, containing as it does all the necessary scientific data, based on first-hand observations, for the design of reinforced concrete structures, with the observations thereon of a group of engineers of the widest and most mature experience obtainable. The instructions are characteristically French in their clearness and boldness—a boldness derived from intimate knowledge, and entirely justified by results.

Price, \$2.50. Sent on receipt of price by CEMENT AND ENGINEERING NEWS, Schiller Building, Chicago.

THE PROBLEMS OF THE CONTRACTOR

Speaking before the Boston Society of Civil Engineers, Mr. Leonard C. Wason, president of the Aberthaw Construction Company, gave a great many very interesting incidents which he had observed during his long experience on buildings.

With regard to weather conditions met with in construction, Mr. Wason outlined many of the points which the contractor must take into consideration when figuring on or supervising construction work.

Protection of Work From Rain

It is unnecessary to protect form work from the rain, as usually it is possible to get only green lumber, its tendency being to shrink out of shape rather than swell. Rough concrete never need be protected from the rain before setting, only from the concentrated run-off over some portion of the work which might wash deeply the cement out of a small area.

A troweled finish, however, must be protected against being pitted by the rain or damaged by concentrated streams. This is usually done by tarpaulin, which consists of 12-oz. cotton duck rendered waterproof after being made into covers 20 feet square. These are supported by a temporary frame. They are somewhat of an inconvenience to the finishers, and decrease the amount of work which they can do.

If rain is expected, it is usual to delay work until after the storm is over, if possible; otherwise, to build a shelter. Sudden showers require quick decision whether there is time to build a shelter, and also its cost, as compared to making repairs on the surface if left exposed. As a rule the shelter is built.

Protection From Sun

If there is to be an unavoidable delay in placing concrete after forms are erected, it is best to protect them from the sun if possible, because they shrink so as to open up cracks which permit the mortar to escape, leaving a bad surface on the concrete. Rough concrete does not require any protection from the sun, with rare exceptions. It is usual to cover up a granolithic finish for at least five days. The materials most available and most economically used for this purpose are rough bags, such as come around bales of cotton or wool, shavings, sawdust, and sand. The object of these is to retain the water which is put upon the surface to keep it wet and to maintain it at a fairly uniform lower temperature than direct sun action permits while setting.

The writer considers it unwise to spray bare concrete in the hot sun, and the use of roofing paper is but little better, because it retains moisture but a very short time. The water falling on a surface heated directly by the sun chills it suddenly, causing it to shrink, and may cause the very cracks which one is trying to avoid.

Protection From Frost

The aggregates must be free from frost when mixed. A live steam pipe can be shoved into the sand pile, the escaping steam heating it and removing all frost. The same may be done with the stone, but a canvas should be thrown over the top of the pile to retain the heat, which more readily escapes. Where a considerable amount of heating is provided for in advance, steam pipes are laid on the ground, and stone as received is dumped upon them. Then there is a canvas thrown over to prevent storms getting into the pile, and to retain heat.

Salt is frequently used in the water to lower its freezing point. It is seldom worth while to heat the water itself. Little care need be used to prevent mass concrete from freezing, as the frost will usually only strike to a depth of about one inch. Buildings are enclosed with tarpaulin tied onto an outside stag-

ing, and the enclosed space is heated with salamanders burning coke. Sometimes it is possible to use steam.

Frost is removed from form work by the use of salt and steam, and if the concrete surface is left rough it is common to sprinkle the top surface with salt to prevent freezing. In winter it is very common to put the finish on as a separate operation, after the building is inclosed, and not as an integral part of the construction, on account of the danger of freezing. When it is put on, it must be kept from freezing for the first forty-eight hours.

The expense of protection against the weather is not very great, and good results can be so surely guaranteed that it is not usual for the writer ever to discontinue work on account of cold weather.

Occasionally it is necessary to make some provision for the protection of the men. Shelters or windshields are built in front of the benches where carpenters are making up forms, as well as around the men at the concrete mixer, whose work does not necessarily keep them warm. Where excavation is going on in the open, it is expedient to have a building with a good fire where the men can warm themselves when necessary; and on a few jobs it has proved to be wise to furnish hot coffee free in these shelters.

ADVANTAGE OF DOUBLE PRIMING

Several large contractors, on important work, use two exploders instead of one when making large shots, so that in case one exploder misses, they can connect up the other one and fire. This saves considerable time and expense which would be lost if they had to draw the tamping and reprime the shot.

CLINTON SAND AND GRAVEL.

The Clinton Sand and Gravel Company of Clinton, Iowa, write us that they pump sand and gravel from the Mississippi River with two 8-inch Morris centrifugal pumps, which are installed on barges. They unload by derricks, using $\frac{3}{4}$ -yard clam shell buckets to cars and hopper where teams are loaded. Their loading outfit is operated by a 50-horsepower, 500-volt Westinghouse motor. The centrifugal pumps made by the Morris Machine Works, Baldwinsville, N. Y., are giving good service, and they have no trouble at all in operating them.

SAND AND GRAVEL

A. C. McEown & Son, 210 Canada building, Saskatoon, Sask., writes us that he is anxious to hear from firms dealing in sand and gravel. He has a large sand and gravel deposit five miles north of Saskatoon, and is willing to sell one-half or whole interest. Saskatoon is growing very rapidly. The population has increased from three thousand to thirty thousand in ten years. Many of the best buildings are of reinforced concrete. This year in public works over one hundred thousand cubic yards of gravel are being used, which will be only a small fraction of what will be required annually in years to come. This year the Dominion Government has built an elevator with a capacity of 4,000,000 bushels, requiring about 75,000 cubic yards of gravel.

Mr. McEown has 327 $\frac{1}{2}$ acres of land, with railroad graded and steel laid into the pits a distance of 4,800 feet from the main line of the C. N. railroad, and has already shipped a considerable quantity. The gravel from his pit has been used in some of the most particular jobs, but there should be a stone crusher, washing and screening plant installed, so that he might compete for any class of work. He has not the capital or time to push his gravel business, and is anxious to hear from some one interested.

NOTES ON SAND-LIME BRICKS

Sand-lime bricks are made of sand or crushed sandstone and lime, mixed together in a moist state and pressed into bricks, the latter being hardened by exposure to steam under pressure so that the bricks when sold have a minimum crushing strength of 2,000 lbs. per square inch. In Great Britain there is no legal minimum of strength, says Brick & Pottery Trades Journal, of London, but on the Continent the figure just mentioned is the official minimum, and it is generally adopted in specifications of important works in this country.

Recent specifications also require other definite properties such as density, porosity and proportion of soluble silica. One specification recently demanded the following limits:

Density, 0.6—0.8.

Porosity, 0.25—0.37.

Water absorption—Between 13 and 21 per cent by weight; between 21 and 35 per cent by volume.

Minimum soluble silica, 5 per cent.

The term density was here stated to mean the ratio (d) between the volume weight (v) and the specific gravity (s) and the porosity (or converse of density) $u = 1 - d$ where $d = V \div S$. The volume weight (v) is the weight of a unit volume excluding the pores.



Sand Lime Brick for This Building Was Furnished by Rockaway Brick Co., Rockaway, N. J.

whilst the specific gravity is the weight of a unit of volume excluding the pores. This use of the term porosity must not be confused with the general use of the word in the sense of water-absorbing power.

Dr. Burchartz has shown that the soluble silica and the density in lime-sand bricks are closely related and that the larger the proportion of soluble silica the less porous will be the bricks. The Dutch commission on lime-sand bricks reached the conclusion that the quality of the bricks cannot be determined by the proportion of soluble silica in them, but is dependent on its distribution. The latter must be ascertained by a microscopical investigation.

These limits will have to be made much narrower if they are to be any use; at present their scope is so wide

that it will permit the use of weak stones or bricks as well as of strong ones. Moreover, what is needed is a test that can be applied without destroying the bricks. The crushing test merely shows that certain bricks are of desired strength; as these are destroyed in the test they cannot be used again, and it is by no means a fair argument to suppose that because selected bricks in a stack are good that all are good. Hence the desirability of a test which can be applied to bricks without in any way damaging them. The density and water absorption tests appear to be of this character, and if the limits were made narrower it is probable that they would be sufficient for all ordinary purposes, though the makers might still continue to make crushing tests for their own guidance, and to have tests of the proportion of soluble silica made in order to control the efficiency of their treatment.

As the sand grains do not naturally adhere to each other, it is only the amount of silicate uniting these grains together which gives the bricks their strength. Not the total amount, however, but the amount distributed to the best advantage in the form of a thin coating of silicate around each grain of sand. This can be observed with a petrological microscope far better than can be ascertained by any kind of chemical test, and it appears desirable that some form of microscopical examination should be made an essential feature of all tests of lime-sand bricks.

Some localities are particularly adapted to the manufacture of lime-sand bricks, but if the prejudice in favor of clay bricks is to be overcome the makers of lime-sand bricks will have to convince builders and others by means of comparative figures. They must also be prepared with some sort of guarantee, and then they will find that, in the right districts, there is ample opportunity for making a good profit from lime and sand, and may even be finding themselves in agreement with the proverb that "sand in the right place is worth more than gold."

THE MORTAR-MAKING QUALITIES OF ILLINOIS SANDS

"The Mortar-Making Qualities of Illinois Sands," by C. C. Wiley of the Department of Civil Engineering of the University of Illinois, has just been issued as Bulletin No. 70 by the Engineering Experiment Station of that University.

Although sand is one of the most common materials in engineering construction its characteristics are perhaps generally the least well known and it usually receives but little care in its selection and use. Specifications for sand are usually so brief and indefinite as to be of little value. This condition of affairs is probably due in a large measure to the lack of definite knowledge of the mortar-making qualities of typical sands and to a lack of appreciation of the fact that sands from different deposits differ greatly in their characteristics and that these characteristics exert a marked influence on the mortar or concrete made from the sands. In this bulletin are given the results of a series of tests on thirty-two samples of Illinois sands obtained from various parts of the State. The effect of the characteristics of the sand on the quality of the mortar is discussed. From these considerations a proposed classification of sands is offered together with specifications for each class.

Copies of Bulletin No. 70 may be obtained upon application to

C. R. RICHARDS,

Acting Director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

BESSER CONCRETE MACHINERY

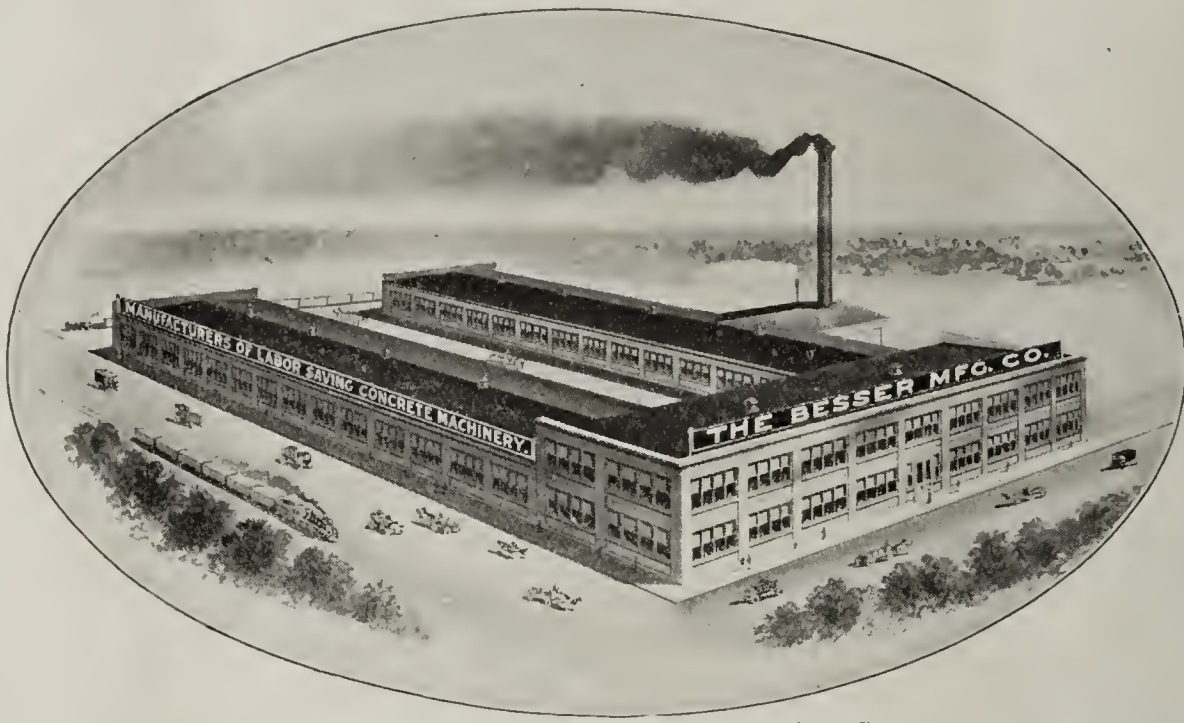
I have been manufacturing and selling concrete machinery for ten years. I have found that most of the buyers have been more impressed by an actual Besser machine in operation than by all the catalogs we could send. I want you to come up to Alpena and see our line of equipment actually at work. I'll pay the railway or boat fare of buyers, depending upon what equipment they purchase, writes Herman H. Besser, President The Besser Mfg. Co., 406 Fourteenth Street, Alpena, Mich.

expenses if you will come up here and see the machines that will suit your purpose.

If you can't come to Alpena, outline clearly just what you need and I will see to it personally that you get every detail regarding my machines, to enable you to make your choice.

LUTEN DESIGN CONCRETE ARCH

The latest booklets from Daniel B. Luten, Indianapolis, Ind., are entitled "Artistic Designs in Reinforced Concrete Bridges, Illustrated by Contrasting



New Factory of the Besser Mfg. Co.

Alpena is a pretty town on the west shore of Lake Huron and it is a fine trip by boat up here in the summer time.

When you get here we can show you our big power brick machines turning out from 25,000 to 60,000 flint-hard, tamped cement brick per day at a factory cost of from \$3.50 to \$4.00 per thousand. We can show you the same machines equipped for turning out 2,000 tamped, hollow building block per day.

You will see the Besser continuous mixers and conveying and elevating equipment mixing and feeding various molding machines, just as they will act as set



Besser Simplified Continuous Mixer.

up in your own plant, reducing the cost of converting the raw materials into finished product. We can show you the Besser power machine for making large drain tile, tamping each tile so compactly that when aged it rings like crockery. You will see the Besser power drain tile machines making drain tile in any size, smoothly and silently, without a jar to disturb the green product.

Write me a letter and tell me just what equipment you are thinking of buying. I'll write you and tell you just what proposition I will make you on your

Views" and "Do Patents Prevent Progress in Concrete Bridge Design?" The attacks made upon this consulting engineer by certain highway departments can not help but give the Luten Design some valuable publicity. They have enabled Mr. Luten to show beyond all peradventure that his policy has been remarkably promotive, that he is the real "beneficent monopolist" of whom we have so often heard and so seldom have seen. He has been a constructive factor in a field which means a great deal to the cement industry and the reinforcing and contracting interests. The rapid advance of the reinforced concrete arch bridge in recent times has been largely due to his untiring efforts and widespread publicity. There is little doubt that the "territorial licensing system" so favored by many concerns that have attempted to market worthy devices for use in the concrete working industry has been a drawback to the trade as a whole. The case of the Luten Design, however, does not offer a parallel instance. Here a consulting engineer as patentee has combined his separate activities in such manner as to not only increase his own business, but also to broaden the field of many contractors and make it possible for communities anywhere in the country to build permanent bridges of the most approved and artistic design. Bridge contractors and county engineers will do well to add these late Luten Design booklets to the working library at once.

LINK-BELT CONVEYORS

Of great interest to engineers will undoubtedly be Catalogue No. 195 of the Link-Belt Co., of Chicago, which describes and illustrates elevating and conveying machinery installed by the Link-Belt Co. for numerous large newspapers and publishing companies as, for instance, the New York Sun, New York Times, Philadelphia Record, Curtis Publishing Co., Minneapolis Tribune and others.

NATIONAL CONFERENCE ON CONCRETE ROAD BUILDING

The proceedings of the National Conference on Concrete Road Building held at Chicago, Feb. 12-14, 1914, have been published in a 200 page book. Copies can be obtained by addressing Cement & Engineering News.

ALLIS-CHALMERS MFG. CO.

Two large catalogues, No. 100 & 103, printed in Spanish describe in detail mining machinery, turbines, gas engines, rotary kilns and other machinery manufactured by the Allis-Chalmers Co. of Milwaukee, Wis. More than a hundred illustrations accompany the text. The world-wide reputation and business connections of the Allis-Chalmers Co. make these catalogues in the Spanish language a necessity and great convenience to prospective customers in Central and South America.

GRINDING VALVES

"Grinding" is the title of a booklet published by the Lunkenheimer Co. of Cincinnati, Ohio, which will be found to be a valuable guide for the workman when grinding valve seating surfaces.

The Composite Brick Company, of Jacksonville, Fla., report business very good. They are selling and moving every week on an average of 160,000 to 175,000 sand-lime brick and are getting some very nice orders from all over the state, even up in Georgia and some in Alabama. They have shipped brick as far south as Key West, which is some 500 miles, and the brick arrived in good condition.

The Farmers' Canning Company, of Rockfield, Wis., recently completed a new plant in which 500,000 sand-lime brick was used, made by the Acme Brick & Sand Company, of Milwaukee. Peter Berres, of West Bend, Wis., was the mason contractor.

The Belt Line Brick Company, of Minneapolis, furnished 1,250,000 sand-lime brick in the new Mazda Lamp building.

DRAIN TILE

A report of the Investigations On Drain Tile of Committee 6 on standard tests and specifications for drain tile of the American Society for Testing Materials is contained in bulletin 36 of the Engineering Experiment Station of the Iowa State College of Agriculture of Ames, Iowa.

MODERN METHODS OF WATERPROOFING.

Modern methods of waterproofing are exhaustively described and intelligently compared by M. H. Lewis in a forty-page pamphlet which should be studied carefully by all would-be users of waterproofing compounds. There are various ways of waterproofing concrete which are not all suitable in every instance. Proper selection of the right method is imperative from case to case. Mr. Lewis' booklet will be found to be a valuable guide to those seeking information on the subject.

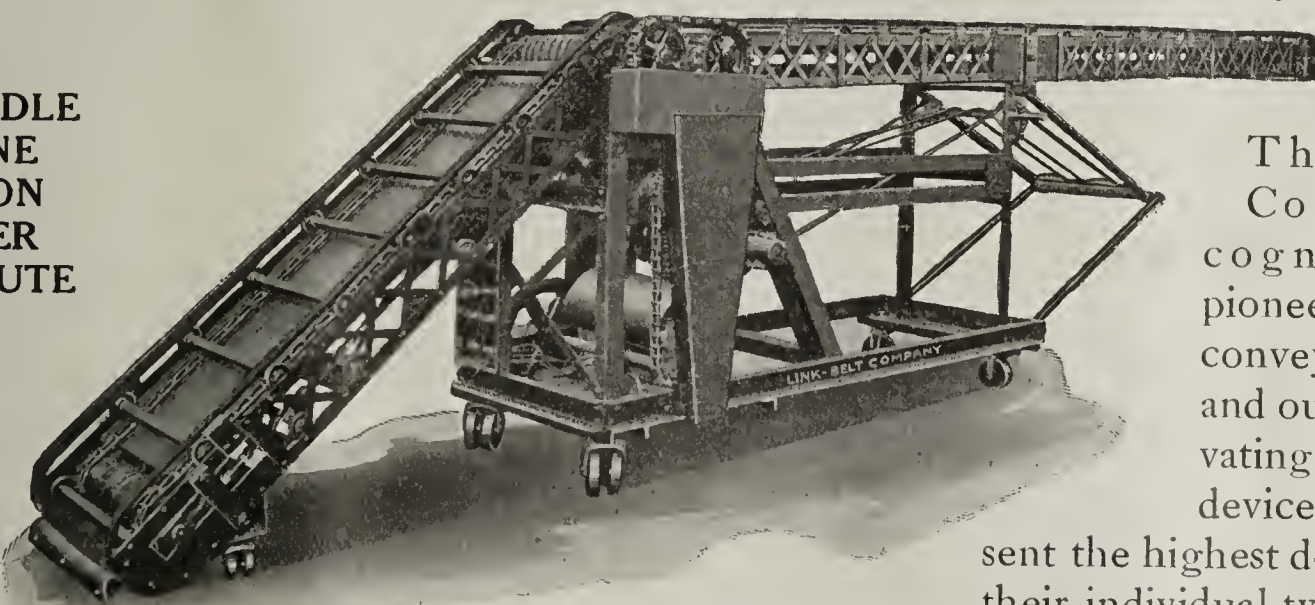
The Nebraska Cement Plant

The Nebraska Portland Cement plant, Superior, Neb., is to be officially opened for business in a few weeks and the directors of the plant have sent out invitations to all of their bondholders to be with them some time during that week; to look over the plant and see it in operation. The whole week will be spent in entertaining the visitors.

LINK-BELT BAG PILERS

Cut down handling costs and increase the efficiency of your men

HANDLE
ONE
TON
PER
MINUTE



The Link - Belt Company is recognized as the pioneer in the art of conveying materials, and our various elevating and conveying devices to-day represent the highest development of their individual types.

Full particulars on request

LINK-BELT COMPANY

PHILADELPHIA

CHICAGO

INDIANAPOLIS

New York299 Broadway
Boston.....49 Federal Street
Pittsburgh.....1501-3 Park Building
St. Louis.....Central National Bank Bldg.

Buffalo.....698 Ellicott Square
Birmingham.....General Machinery Co.
Seattle.....512 1/2 First Avenue. S.
Denver.....Lindrooth, Shubart & Co.

San Francisco.....N. D. Pelps, Sheldon Bldg.
New Orleans.....Whitney Supply Co.
Los Angeles.....204 No. Los Angeles St.
Detroit.....911 Dime Bank Bldg.

PORTABLE SCREENING PLANTS FOR SAND AND GRAVEL

The C. H. Little Co., of Detroit, are producers and dealers in builders' supplies, operating and selling very extensively in, and about, Detroit. They own several good gravel deposits, four of which are being worked by means of portable screening plants, as illustrated herewith. By the use of these portable plants, running on rails through the gravel bed, it is possible to always select a grade of gravel to suit the demand. This is particularly important in these beds as the size of the gravel and the proportion does not run uniform although all is of a good grade.

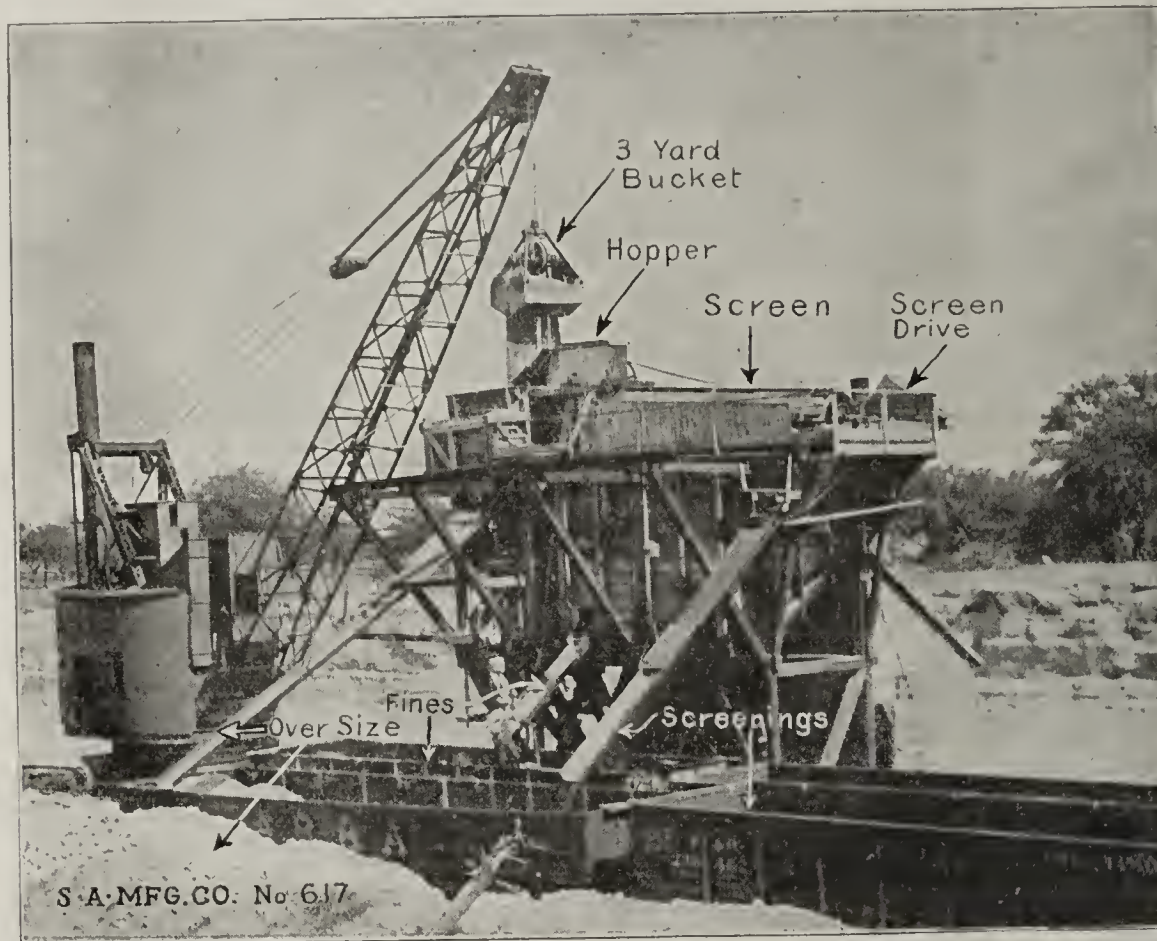
Each screening outfit consists, essentially, of a loco-

and it is, consequently, impossible to deliver the "riddle" to the cars.

The rated capacity of these screening plants is 65 yards per hour, although this varies within a considerable range, depending upon the character of material being handled.

Plants of this type are used by the C. H. Little Co. in their gravel beds at Wilmington, Utica, and Orien, all in Michigan. They also use one in their Delray Yard, Detroit, which works from material dredged in the lakes and brought in on barges.

These plants are considered by the owners as very profitable investments and as logical solutions of their particular screening and handling problems. These



Portable Screening Plants for Sand.

motive crane connected to a heavy truck, on which is mounted an engine and boiler, and a frame supporting the screen, bins, chutes, and transmission machinery.

The boom of the locomotive crane is set at the necessary radius to bring the bucket above the hopper, and is worked in that position all the time. McMyler Cranes are used with three-yard buckets. These cranes furnish power, not only to propel themselves, but also to move the screening plant as the two are rigidly connected.

The screening plant, shown herewith carries a ten-yard receiving hopper which feeds the screen. From this hopper, a grizzly separates all material over two inches and chutes it over the cars to a waste pile. The "riddle," or that passing through the grizzly, may be passed directly to the cars without further screening; when it is required to deliver sized material, the gravel is passed through the screen and the $\frac{3}{8}$ -inch separations passed to one car and the screenings to a car on another track.

A cylindrical screen is used 16 feet long, covered with $\frac{1}{2}$ -inch wire cloth. The screen is driven from a 22 horse-power engine, which, with a vertical boiler, is carried on the same trucks.

One of their screening plants has no preliminary grizzly, but the screen is equipped with internal grizzly bars. In this way, the oversize is separated by the screen simultaneously with the other separations

were designed and the equipment manufactured by the Stephens-Adamson Mfg. Co.

IMPERVITE

One of the greatest objections to concrete and stucco as building materials has been the fact that it was difficult to render the surface absolutely waterproof. By using the greatest care and skill in mixing, as well as carefully selected materials, it was sometimes possible to obtain an approximately impervious mixture, but, as a rule, the dampness would show through the wall after a heavy rain.

With the intention of furnishing contractors with a material for use in these cases, the Standard Paint Co., Impervite, Dept. K, New York, N. Y., have prepared "Impervite." This is an asphalted paste, which mixes readily with the water used in mixing sand and cement and, when used according to directions, it gives a surface through which no water or dampness can penetrate.

The Standard Paint Co. has prepared specifications for the use of Impervite in stucco, whether on terra cotta, concrete blocks, brick or lath, as well as numerous suggestions and directions for its application under practically all circumstances and conditions. These specifications, as well as the other information, will be sent free to those who are interested in stucco or concrete construction.

Lansing Broncho Batch Mixer



\$200 and
up.

Sizes 7 to 10
15 Cu. Ft. Capacity

Better Than the Best

Only costs a fraction as much.

New 1914 Models

Here's the new 1914 Model Lansing Broncho—"The Daddy of All Mixers." A strong, powerful mixer that is better than the best and only costs a fraction as much. Not a cheaply made machine at a cheap price; but a high grade, first class mixer at popular price. A machine every contractor will be proud of. Strong where strength is needed. High wheels for easy moving; low intake for quick, easy loading, high discharge for wheelbarrows or forms. Easily cleaned; quickly and easily moved. Equipped with all of the latest and most modern devices, and built on the most modern and sensible lines, combining few wearing parts with great strength and speed.

**No Other Mixer
Combines all of These Features**

Low charging for wheelbarrows or shovels. Measuring hoppers for those who want them. Side loaders for big jobs; high discharge for wheelbarrows or forms; simple, strong, powerful engine; non-slopping rings; quick mixing principles; ball and socket fifth wheel for short turn, and to avoid racking of frame on uneven ground; few wearing parts for economical up-keep; high wheels for hauling steel drum; machined bearings; steel channel frame; friction clutch for starting and stopping; quick mixing, cleaning and dumping principles. Most mixers have some, but the Broncho combines all of them—the most satisfactory machine made from every required standpoint.

**1914 Models Are Marvels
of Strength and Speed**

They produce a quality of mix that every inspector accepts and pronounces *good*, doing it at most satisfactory rate of speed—600 batches and over per day, if required. Discharge operated instantly without the usual slopping. Mixer is reinforced, braced and strengthened at every possible wearing point. Machined track and bearings; channel iron frame (cross and corner braced), insuring the longest possible life and greatest wear. Designed to carry loads of from 1,000 to 5,000 pounds of concrete every batch, 10 hours a day, and 365 days in the year. Adopted by the largest and most exacting contractors in the country.

**We Also
Manufacture**

Continuous Mixers
Mortar Mixers
Hand and Power Mixers
Block & Brick Machines
Ornamental Moulds
Tools Barrows Carts
Scrapers Sand Screens
Mortar Hods
Mortar Trays, etc.

Send for Catalog

The Lansing BRONCHO is Truly the Biggest Value Ever Offered. You don't buy mixers every season and you don't have to with the Broncho. Every dollar saved in equipment is so much more profit, and

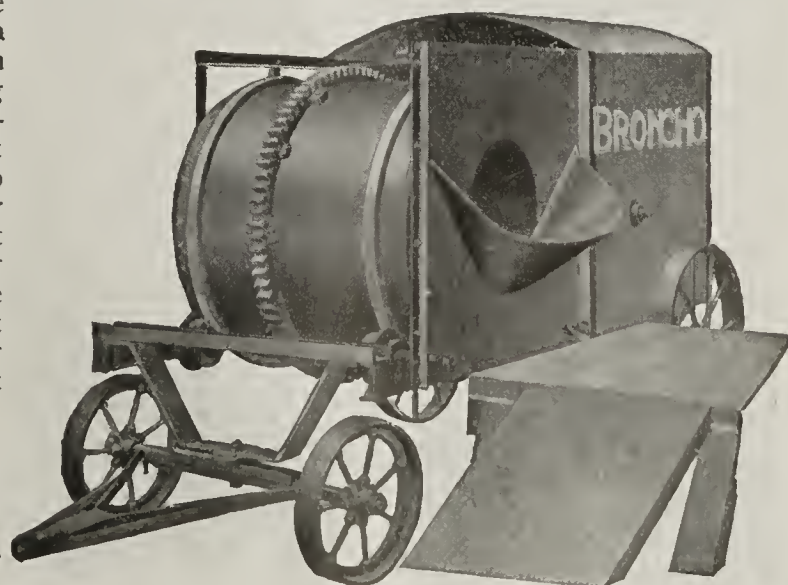
profits are what mixers are built for. Why invest in a cheaply built machine when you can get a well built, long wearing, well designed machine at the same price? Don't be content merely with a cheap mixer, but get a good mixer at a low cost. Do not invest a dollar in a concrete mixer until you have learned more about the Lansing Broncho. It is truly the biggest value ever offered in good machinery at low prices.

LANSING COMPANY

747 CEDAR ST. LANSING, MICH.

Branch Houses

New York Boston Philadelphia
Chicago Minneapolis
Kansas City San Francisco



THE MODERN METHOD OF CRUSHING ROCK

Did you ever take the stem of a match and stamp on it; you can flatten it out if you stamp hard enough. Now take another piece and roll it under the foot. With half an effort it is ground to shreds. We apply that same motion, the rolling of material along a stationary surface to the Universal "forced-feed" crusher, writes the Universal Crusher Company, Dept. 14, Cedar Rapids, Iowa. That's where it gets the name "Forced Feed"—so you can see right away that we have a right to claim a bigger capacity for our crusher with the same or less horse power.

In a gravel pit most of the material dug from the bank is damp and slippery, sometimes wet and muddy. That's mean stuff to crush. Did you ever see a piece "pop" out of a crusher and fly twenty feet in the air. It is not at all uncommon with the old type crusher. But in a machine like the Universal it can't do this. It is dragged into the machine by the same pushing, rolling motion of the movable jaw that crushes it so easily and so fast. It can't clog no matter how wet it is. It just simply has to go through.

Now in a machine with a motion like this gravity doesn't cut much of a figure. In old style crushers the rock drops away from the jaws, but in the Universal Forced Feed Crusher, it drops away at a rate that makes you wonder how it is done. It is forced through and away from the jaws.

That is the kind of crusher you need in your plant. It can't be broken because its strength is figured on the basis of five times the load it will ever have to crush. You could stall an engine of five times the required horse power before any part would give way. And the chances are that the safety toggle plate behind the movable jaw would be the only thing that

would give. That can be replaced in about three minutes' time and at a trifling cost.

Grasp for a minute these points of distinct superiority. Open hearth steel frame, nickel steel shaft, manganese steel jaws, replaceable phosphor bronze bearings, and the smoothest, coolest running proposition with two wheels. This machine has come to stay. Twenty years of manufacturing experience are represented in these crushers. There are sizes for every imaginable purpose, some with capacities as small as a ton an hour and some that will crush forty tons an hour. In every machine you find the feature of adjustment to crush to any size. That in itself is worth a good deal in a gravel plant. Send for our Folder No. 10, which contains valuable information on crushing. The Universal Crusher Co., Dept. 14, Cedar Rapids, Iowa. Mention Cement & Engineering News when writing.

SAND AND GRAVEL PLANTS

A new booklet has just been issued entitled, "Plants for using Sand and Gravel," illustrated, 40 pages and cover, 6¾"x10", by Raymond W. Dull Co., 1912 Chamber of Commerce building, Chicago, Ill., who will gladly send a copy, gratis, to readers of Cement & Engineering News. It contains a well printed, profusely illustrated description of plants for using sand and gravel, describing in detail conical screens and screens of other designs, scrubbers and sand separators, belt conveyors with tables of calculations for speed capacity and driving power required for these conveyors, elevators, dragline excavators, feeders, portable gravel washing equipment for contractors, etc. This is followed by illustrated descriptions of various plants recently installed by this company.

THE BISHOP PATENT DERRICK EXCAVATOR

FOR HANDLING SAND, DIRT, GRAVEL, CRUSHED STONE, ETC.

There are only two machines that will dig material that is met with, and they are the steam shovel and the dipper dredge. By using the Bishop Patent Excavator, any derrick having a rectangular or a square boom can be converted into a steam shovel or a dipper dredge made out of a derrick boat.

This apparatus can dig anything a steam shovel will dig, and

its range is from the base of the derrick to the end of the boom and below the base of the derrick the length of the dipper arm.

WHY KEEP AN EXPENSIVE

steam shovel at work at the pit excavating sand and gravel when lower-cost equipment will do the same work? With your regular derrick you can dig material from the bank, you can excavate earth, you can handle loose materials on the construction job.

The Bishop Patent Derrick Excavator is an attachment that is readily adjusted on your derrick. It consists of a carriage traveling on the boom, a dipper and a dipper arm. A square or rectangular derrick boom, a double-drum engine and swinging gear are required. One man operates the equipment.

UNION IRON WORKS

HOBOKEN,

ERIE SIDING,

NEW JERSEY



TO STAND THE JAR OF ROUGH ROADS

Contractors have often been heard to remark: "It is not so much on the job that I wear out my mixer, but rather in getting from one job to another. The jolt and jar of rough roads and the racking of the frame from the unevenness of the ground soon works the bolts and nuts loose and the mixer tears itself to pieces."

This expression was quoted recently by a representative of the Lansing Company, 747 Cedar street, Lansing, Mich., and he continued:

"We all know it would not be practical to put a piece of machinery like a mixer on springs, but in the Broncho Mixer, made by the Lansing Company, particular attention has been given to a type of construction that will be as free as possible from the bad effects usually found from drawing a mixer about on country roads and rough streets.

"In the first place, a patent spring washer is put underneath every nut, which prevents it from working loose under any conditions, and the only way it can be taken off is with a wrench. Even a more important feature to gain the desired end is found in the ball and socket fifth wheel. This is a device found almost exclusively on heavy road rollers, where a certain amount of flexibility is absolutely necessary. One wheel can go right up to the frame, the other may drop down six or eight inches into a rut or pitch hole without changing the level of the frame or causing strain or racking.

"This ball and socket fifth wheel has the further advantage of allowing a full circle swing of the front wheels so the mixer can be completely turned around without moving one rear wheel from its place. That makes it mighty convenient in getting around sharp corners, or in setting the mixer in tight quarters.

"The Lansing Company, 747 Cedar street, Lansing,

Michigan, claims many other superior advantages for their Broncho line of mixers, now made in five sizes, and offer to send catalogues to anyone wishing them and also outlining fully their new two-year guarantee against wear, which is well worth looking into."

PORTABLE BUCKET ELEVATOR FOR LOADING MOTOR TRUCKS

One of the objections raised by contractors to the use of motor trucks is that in loading from a storage pile by hand shoveling the truck is idle a large part of the time while receiving its load. To obviate this loss of time a portable loader has been devised, consisting, as the illustration shows, of a bucket elevator mounted on four wheels, with power supplied by a motor or a gasoline engine. Such an equipment is said to be capable of loading coal, sand, gravel or crushed stone at the rate of a ton per minute. The truck driver trims the truck with a shovel, and one, two or three men, depending on the nature of the material, trim and feed to the loader. It is claimed that this combination will load a truck at a cost of from 2½ to 5 cents per ton, as compared with from 8 to 12 cents per ton by hand shoveling.

In a further development of this system the loader elevator is mounted on the rear of the truck body and is arranged so that it can be lowered in a storage pile or raised clear of the ground when not in use. The elevator is supported independently of the dumping body, and is driven, through a clutch, by a connection to the truck transmission. This combination results in a truck which can be loaded by its driver with or without a helper in a few minutes, and does away with the necessity for a loader operator who is idle between trucks.

Both types of loaders are made by the Link-Belt Company, of Philadelphia and Chicago.

The Eclipse Portable Stone Unloader

Makes Increased Profits for Road Contractors



This machine unloading crushed stone, sand, gravel, slag and coal from any kind of a drop bottom railroad car solves one of the biggest problems with which a contractor has to contend. In operation the material runs from the bottom of a car thru a chute equipped with a gate to control or cut off the flow into the hoisting bucket. When the bucket is filled the gate is closed and the material is hoisted and automatically dumped in the unloader bin. It is then ready to be loaded onto wagons thru the chutes provided for this purpose. One man operates it.

WRITE FOR COMPLETE INFORMATION AND PRICE

READ WHAT THESE MEN SAY

SOUSLEY & BRITTON

Plymouth, O., Dec. 1, 1913

The Galion Iron Works Co., Galion, Ohio.

Gentlemen: In regard to the "Ideal Unloader" we purchased from you, will say that it was the best investment we ever made, as we think we have paid for it on only two miles of road and it is apparently as good as ever.

We would advise anyone building roads to buy one if they only build one mile a year.

Yours truly,

SOUSLEY & BRITTON

We also
manufacture a
complete line
of road making
machinery and
culvert pipe

SOUDER & PETER

Fostoria, O., Nov. 27, 1913

Mr. E. G. Glendhill, Galion Iron Works Co., Galion, Ohio.

Dear Sir: We have been using one of your Galion stone unloaders and has given us very good satisfaction. Have tested thoroughly and it proved very satisfactory. It will do more than you stated. We have unloaded three hundred and fifty (350) yards in ten hours. Wouldn't do without one of them for twice the price paid.

Your respectfully,

SOUDER & PETER.

THE GALION IRON WORKS & MFG. CO.

Home Office and Works: GALION, OHIO

BRANCH OFFICES:

New York Chicago Milwaukee Pittsburg Harrisburg Des Moines Atlanta Memphis Columbia, S. C. Moberly, Mo. Enid, Okla. Philadelphia
Richmond, Va. Minneapolis, Minn.

HYDRATED LIME

FOR WATERPROOFING CONCRETE

Hydrated Lime is not only the best but also the cheapest water proofing compound known, since it replaces so much cement and the only additional cost is the difference between the price of cement and hydrated lime, which is slight, even at the present low price of cement.

As an actual waterproofer, hydrated lime is not surpassed by any of the waxes and paraffin compounds at the present time used for this purpose. Many of these compounds are organic, and in time will volatilize, leaving the concrete porous. Hydrated lime, on the other hand, is inorganic or mineral, and will remain where it is put.

As an example of the waterproofing properties of hydrated lime, this was employed upon the large concrete reservoir at Rockland, Massachusetts, built by Simpson Bros. Corporation, the well known contractors and engineers, 166 Devonshire Street, Boston, Mass.

See next page for list of lime manufacturers who make hydrated lime and who will gladly furnish you samples, circulars and any information you desire.



Concrete Reservoir at
ROCKLAND, MASSACHUSETTS, ERECTED IN 1910
For the Towns of Rockland and Abington

Dimensions: 46 feet diameter; 104 feet high; capacity, 1,662,000 gallons. Designed and built by Simpson Bros. Corporation, Boston

To make this reservoir watertight, hydrated lime was added equal to 10 per cent. of the cement to the concrete when it was being mixed.

ERIE CENTRIFUGAL PUMPS.

The Erie Pump and Engine Works of Erie, Pa., has recently issued three new bulletins describing its centrifugal pumps. Bulletin No. 29 is devoted to Erie Class L low head centrifugal pumps, which range from 1½ to 12 inches in size and from 60 to 4,500 gallons per minute in capacity. These pumps are made with either horizontal or vertical shafts, either belt connected or direct connected to a single or a double cylinder steam engine. The book also contains revolution and friction head tables for the different sizes of pumps.

Bulletin No. 30 contains 32 pages descriptive of Erie sand and gravel dredging pumps. These are centrifugal pumps of strong construction, with a heavy, specially designed impeller with as large passages as possible. These pumps are used, not only for producing sand and gravel for commercial purposes, but also for pumping a great variety of fluids and even semi-fluid substances, and for contractors' uses. These pumps will handle large quantities of water in excavation work and become especially valuable when there is a considerable percentage of solids. The pumps are built of iron or of steel, the latter costing from 40 to 60 per cent more than the former. They are built both right and left hand, with steam or electric driving power. The catalogue also includes pump and pipe fittings, such as suction hose, flexible ball joints, riveted pipe, gaskets, flanges, etc. The bulletin is illustrated with cuts of the different pumps and parts, and with photographs showing them in operation and the character of the work they do.

The third bulletin, No. 31, deals with Erie high duty centrifugal pumps. These are of different types, some single suction, others double suction, while some are two-stage, or compound. All these catalogues are of

interest to contractors and sand and gravel producers and to anyone who has pumping work to do.

KOPPEL CARS IN CONSTRUCTION OF DALLES-CELILO CANAL.

On the completion of the Celilo Canal around the rapids of the Columbia River at Big Eddy, Oregon, will be finished one of the largest projects of its kind in the country.

The canal proper will be eight and one-half miles long and sixty-five feet wide on the bottom, and will make the Columbia River navigable for several hundred miles.

It is mostly through solid rock, and approximately six steam shovels, twenty locomotives, and one thousand men have been working day and night for the past three years to complete the work on record-breaking time.

More than three million yards of concrete will be used on the contract, and this is hauled, after mixing, from five hundred feet to two and one-half miles, varying with the requirements of the work.

This concrete is used for the various lock walls and the walls of the main canal.

For use in transporting the mixed concrete, a number of V-shaped dump cars were secured by the Contractors Equipment Company, who are handling the work, from the Orenstein-Arthur Koppel Company of Koppel, Pa., these being of two yards capacity and of the side-dumping variety.

The canal is located about ninety miles east of Portland, Oregon, and when in operation will permit boats to pass what is known as "The Dalles" of the Columbia River and Celilo Falls.

HYDRATED LIME

is being demanded by engineers, architects, dealers, manufacturers, contractors and builders everywhere. It can be manufactured now as cheaply as quick lime and it possesses certain properties making it more useful and valuable to builders than ordinary quick lime. It requires, however, great care and extra costly machinery in the manufacture of hydrated lime.

Hydrated lime is shipped in bags the same as cement, making it easy to handle for both the contractor and dealer. It is not only the Best but also the Cheapest concrete waterproofing compound known.

Write for printed matter, information, etc., to any one of hydrated lime manufacturers listed below—the nearest to your city

Longview Lime Works,
Birmingham, Ala.

Charles Warner Co.,
Wilmington, Del.

Marblehead Lime Co.,
Chicago, Ill.

Ohio & Western Lime Co.,
Huntington, Ind.

Security Cement & Lime Co.,
Hagerstown, Md.

Lee Lime Co.,
Lee, Mass.

Charlevoix Rock Product Co.,
Charlevoix, Mich.

Glencoe Lime & Cement Co.,
St. Louis, Mo.

Dutchess County Lime Co.,
Scarborough-on-Hudson, N.Y.

Rockland & Rockport Lime Co.
101 PARK AVE. New York, N. Y.

Kelley Island Lime &
Transport Co.,
Cleveland, Ohio.

National Lime & Stone Co.,
Carey, Ohio.

John D. Owens & Son Co.,
Owens, Ohio.

Nat. Mortar & Supply Co.,
Pittsburg, Pa.

Gager Lime & Mfg. Co.,
Chattanooga, Tenn.

Dittlinger Lime Co.,
New Braunfels, Tex.

Riverton Lime Co.,
Riverton, Va.

International Lime Co.,
Sumas, Wash.

Standard Lime & Stone Co.,
Fond Du Lac, Wis.

Union Lime Co.,
Milwaukee, Wis.

Among The Cement Mills

CEMENT COMPANY RECOVERS KILN DUST

By T. J. Fleming*

Recovery of dust from the waste kiln gases of the Colton plant of the California Cement Company is accomplished by a patented system of gravity separation and washing installed during 1911 in connection with five 7½x125-foot rotary kilns. Other units have since been added. The dust-collecting system is the outcome of a lawsuit brought against the cement company by orange growers who contended that their fruit was being spoiled by the dust from the plant. This article will deal with the dust-collecting plant for five 8½x150-foot kilns, each with a capacity of 750 barrels per day. The total amount of dust recovered per day is 75 tons.

A draft in the cement kilns is produced by fans located between the kilns and dust house. A large part of the dust is then captured in the dry state by reducing the velocity of the gases, and the remainder of the dust in the gases, together with the noxious gases, is washed out by sprays and sheets of water. The gases from each kiln are drawn by individual fans through separate flues and are discharged directly into the dust house. The flues first rise, then curve over and slope downward toward the fans. The flues are 6½ feet in diameter and about 180 feet long. Each flue is provided with necessary expansion joints and is lined with firebrick for a distance of about 20 feet. The fans are of special exhaustor type, 5 feet wide and with wheels 10 feet in diameter. They are made by the B. F. Sturtevant Company. They are equipped with water-cooled bearings, and operate at a speed of 145 to 150 r. p. m., being driven by 40 horsepower motors.

The volume of gases discharged from each kiln when operating at 750-barrel capacity per day is approximately 25,000 cubic feet per minute; the temperature is 900 to 1,000 degrees Fahr. The temperature of the gases at the fans does not exceed 800 degrees, and the velocity in the flues does not exceed 15 feet per second. The fans have been installed to manage an excess of gases in case of leakage of air and also for the necessity of drawing cold air through the kilns when they are being relined or repaired.

Dry and Wet Chambers

There are two departments to the dust house—the dry chamber and the wet chambers. The former, which receives the gases directly from the fans, is one large room, 100 feet wide, 155 feet long, and with an average height of 31 feet. The dry chamber is of steel-frame construction, the sides and roof being covered with galvanized corrugated iron in order to assist radiation as much as possible. There are ten cross-tunnels leading to a longitudinal tunnel running lengthwise with the dust chamber. In these ten tunnels are located screw conveyors with steel troughs and spouts. Gates lead from the floor above into the cross-conveyors for drawing off the dust. Each of these cross-tunnel conveyors discharges into one common conveyor in the longitudinal tunnel, continuously carrying the dust back to the raw department of the plant, where it is mixed with the raw material going directly to the kilns.

Stokes developed a formula which means that the wind velocity necessary to support a particle will

vary as the square of the radius; or inversely, the radius of the particle which the wind can support will vary as the square root of the velocity. While this formula has not been proved to be correct, it may be approximate, and this theory was applied in designing the dry dust chamber of the dust house. The temperature of the gases in the dry-dust chamber has been reduced to about 400 degrees Fahr., and the average velocity of the gases reduced to less than 1 foot per second. This results in a very heavy dust fall in this chamber and the dust is in the best condition for returning to the kilns.

The five chambers in the wet or washing department are each 60 feet long and 20 feet wide. They are of steel framework, similar to that of the dry department, but the steel framework is protected by brick lining. The roof of the wet chambers is of expanded metal, with cement plaster both inside and outside.

The dry chamber connects with each wet chamber by means of two openings through which gases are discharged. These openings are closed, when desired, by means of gates dropped down from above, so that the walls and sprays in the wet chamber may be cleaned when necessary without affecting the operation of the kilns or the balance of the house. The gates are of concrete with steel framework and other reinforcement and hang by two iron rods running up through the roof. These rods are carried by two channels, back to back. After the cleaning operation is over the openings around the two rods passing up through the roof are cemented with asbestos plaster.

Each chamber consists of a series of baffles changing the direction of the current of the hot gases passing through. The gases coming out of the dry chamber pass up over the first baffle, down and through a sheet of water, under the second baffle, then through another sheet of water, over a third baffle, then up and

REQUIREMENTS FOR PLANT OF 3750-BARREL CAPACITY.

	Hp
Slurry pumps	15
Circulating pumps	80
Screw conveyor for returning dust.....	25
5 exhaust fans at 30 hp. each.....	150
Total	270
Labor:	
Dry department	2 men, day
Dry department	1 man, night
Wet department	2 men, day
Wet department	1 man, night

down and onward to the last section, where the exhaust passes through a ½-inch mesh screen to the atmosphere. Sprays are located in all corners and at the top and bottom each baffle, with the exception of the section between the dry chambers and the first sheet of water. Sprays are also located 2 feet above the screen in the exit chamber.

The floor under the wet department slopes from the dry chamber 1¼ inch per foot in order to carry away the water with its load of dust. Alternate baffles are raised 6 inches above the floor, permitting the water to pass freely to the overflow.

There is a door in the end of each wet chamber, and in line with the outside door are swinging doors in each baffle. These doors are closed except during the period of cleaning out or examination, about once a month. The exhaust from the dust house is a cloud of atomized water and steam. The temperature in the exit chamber is from 100 to 125 degrees Fahr.

*Secy. & Genl. Mgr., California Portland Cement Co., Los Angeles, Calif.



A Ten Day Old Factory

KNOWING WHERE THE REAL PROFIT lies, the Norwalk Vault Company has just established in Long Island City a plant of its own to take care of the New York demand for cement burial vaults. This photograph, which, by the way, shows rather interestingly the simplicity of the molds and method of making, was taken there the week after work began.

The National Casket Company, after a thorough investigation of the merits of the Norwalk Vault, has undertaken to act as general sales agent for the Metropolitan district, and when the vault itself becomes fairly well known around New York, a splendid business is expected.

AS SOON AS THE NEW YORK FACTORY is fairly under way, the Norwalk Company expects to open up a similar establishment in another city—Boston or Philadelphia, perhaps. Atlanta probably will follow, then some city quite far West; and so on down the line, until the company is represented either by its own plant or by some equally efficient local manufacturer in every section capable of supporting a first class vault business.

NATURALLY, THE FIRST TERRITORY selected for development will be that in which there has already been built up a demand for a cement burial vault of some kind or other. Local manufacturers under the National Vault patents, however, may rest assured that they will not only be fully protected in all their rights, but that they will be regarded always by the reorganized Norwalk Company as full partners in the campaign for nation-wide supremacy of the National Vault.

MOREOVER, the Norwalk Vault Company would be glad at this time to hear from a dozen or more men, now making money manufacturing cement or concrete products, who would like to double or triple their present income by joining with the Norwalk Company and the 200 local National Vault manufacturers already in the field. The United States is pretty big; and for the Norwalk Company to cover it all with its own shops would take far too many years. There is, therefore, this opportunity for the right men to take over local manufacturing rights—and get in on the ground floor of what is to become one of the great manufacturing businesses of this country.

PLEASE DON'T CONFUSE this with the old-time peddling of molds for making cement vaults, as practiced by those companies that live on the profits from the sale of their molds to you and leave you to develop your sale of vaults as best you can. Even under these circumstances, a good many local agents are making money selling vaults. But the Norwalk Vault Company is no more in competition with these smaller companies than the Railroad is with the trolley company or the National Biscuit Company with the local bakery.

THE VALUE OF THE NORWALK LICENSE and of Norwalk sales co-operation will increase greatly as each territory now unoccupied is filled by the right man—and these territories today may be had by the right man for a cash outlay astonishingly disproportionate to the possibilities of cash return. But the prices go up on September 1st.

WHAT ABOUT YOUR TERRITORY? Are you capable of fitting in with a big national organization and taking care of your county, say? If you are, the amount of money you can make depends only on the size of your territory and your own enterprise. The business is there—waiting!

HERE IS A STEADY STAPLE manufacturing line for a practical concrete or cement man who is ambitious enough to want a business bigger than a street paving job or an artificial stone plant. Practically no competition. Potential demand almost unlimited. **Find out who has the rights in your territory.** If you could make good, send without delay for further particulars. Prices go up all along the line on September 1st, and again every six months or so thereafter. So immediate action may save you money.

The Norwalk Vault Company,

**38 Seminary Avenue
NORWALK, OHIO**

The dirty water, containing about 0.1 pound per cubic foot in suspension and an equal amount in solution, falls from the floor of the wet chambers into a set of screen-covered launders or troughs leading to the primary settling tanks. The temperature of the water as it leaves the chambers is about 117 degrees.

Settling Tanks

The settling tanks are made of steel and are conical. The thick slurry from the eight primary settling tanks is siphoned up to troughs leading to the secondary tank, where the operation of separating the water from the dust is repeated. The clean overflow water from the primary and secondary tanks is returned to the sump for further circulation in the wet chamber. The thick slurry from the secondary settling tank is continually pumped back to the kilns, where each kiln receives its proportion of slurry mixed in with the dry material coming from the raw department. Both the slurry and water for circulating are handled by centrifugal pumps driven by electric motors.

The total amount of water required for the five $8\frac{1}{2} \times 150$ -ft. kilns is 2,700 gal. per minute, of which 350 or 400 gal. per minute are evaporated or lost. The 350 to 400 gal. are replaced by new water from the original source of supply. The temperature of the clean water which is returned to the house is about 100 deg.

The total amount of dust recovered per day is about 75 tons, 50 tons being from the dry department and 25 tons from the wet department.

The approximate horsepower required continuously for this installation including the power required for the slurry pumps and conveyors carrying the dust back to the raw department, is 120 hp, to which should be added the power required for operating the fans and handling the hot gases from the kilns.

The development of this dust settling system was compulsory, being brought about by the action taken against the California Portland Cement Company by the orange growers whose groves were near the plant. The courts have decided that the system has fully demonstrated that it gathers all the troublesome dust arising from the kilns and dryers in the manufacture of cement, and the plant is now operating at full capacity.

The system has been designed and patented by the author.

TEXAS CEMENT COMPANY RE-IN-CORPORATED

The Texas Portland Cement Company, Dallas, Texas, recently re-incorporated, is now in operation under its new management. The company, which has been operated for a number of months in the hands of receivers, is now being operated with a capitalization of \$750,000 and bonded indebtedness of \$500,000. Before going into the hands of receivers the company was operated with a capitalization of \$3,000,000 and a bonded indebtedness of \$2,000,000.

It is said that a complete transfer has taken place with respect to the stock of the company. There is now but one of the original stockholders in the new concern. The company was formerly in the hands of West Virginia magnates, but the capital stock, with the exception of one stockholder, is now held by Texas people.

No changes have been made in the plant or the operation of it. F. R. Bissell has been elected president and general manager and the plant will be conducted under his direct supervision.

NEW MOTORS FOR CEMENT PLANTS

The Riverside Portland Cement Co., Riverside, Cal., has ordered for its mill three 15 hp. and one 200 hp. motors.

The Three Forks Portland Cement Co., Trident, Mont., has arranged to install for electric drive in its mill seven motors ranging from 25 hp. to 200 hp., two 30 kv-a, transformers, switchboard, etc., the equipment having already been ordered.

The American Cement Plaster Co., Lawrence, Kans., will equip its plant at Acme, Tex., with electric drive and has ordered twenty motors ranging from 3 hp. to 25 hp. with switches, etc.

The International Portland Cement Co., Spokane, Wash., will install two 150 hp. motors and starting compensators.

PAPER CEMENT CONTAINERS

Portland cement has grown into one of the very largest industries in the world, the demand for it extending to the remotest quarters of the earth, even beyond the modern facilities for transportation. In many of the inland mountainous countries the burro (that little beast of burden) must carry it from the water's edge to the interior.

Perhaps the most perplexing problem to the manufacturers, dealers and contractors of this great commodity is the best and cheapest way to pack and deliver it. However low a container may be for this purpose, the enormous output necessitates the outlay of millions of dollars per annum.

You will remember in its incipency an expensive wooden barrel was used, and must be yet, in rare instances. Then came the cloth bag; though unpopular at first, it grew rapidly in favor, like the barrel, only to a much greater extent, and must be considered a most excellent container for shipments that undergo unusual hardships. The paper manufacturers then put their inventive minds to work and brought out a single service paper sack, which answers the purpose admirably because there is no loss of cement in sifting or sticking to them, no loss in untying, no loss from stealing, no loss in counting, no loss in carrying to place of safety, no loss in gathering them up, no loss in mending, no loss in cleaning, no loss in bundling to ship, no loss in returning and no loss in carting and marking.

There are no disagreeable contentions with the manufacturers or customers as to the number returned or the conditions of them. They require no tedious and expensive bookkeeping, and create no unpleasant settlements between manufacturers, dealers or customers. It must be an undeniable fact that all manufacturers and dealers in cement lose some bags; if not, what becomes of them? Millions and millions are bought each year to replenish the ones that are gone.

While paper costs ten cents a barrel, the first cost is also the last, and in one thousand barrels of cement in paper bags, you have only one hundred dollars invested as first cost of the sacks.

There is a paper bag made especially for carrying the materials named herein, manufactured by the Urschel-Bates Valve Bag Co., Toledo, Ohio, and which is known as "Bates" valve bags. It is a storm-proof bag, having the valuable quality of turning rain or snow, thereby holding the contents dry when exposed. You can generally procure it from your manufacturer by merely requesting, "Ship this order in Bates paper valve bags." No additional cost is attached to this request.

THEORY OF CEMENT ACTIVITY

In a paper read before the German Association of Portland Cement Manufacturers, Dr. Rohland of Stuttgart, points out that the setting of Portland cement is a colloido-chemical phenomenon, embodying the congelation of colloidal substances with simultaneous crystallizations. Passing then to the question of the protection afforded by concrete to embedded iron, he suggests that the true cause of this is the formation of calcium hydroxide. Having called attention to the fact that iron is the only structural metal which cannot be oxidized in the presence of an alkaline liquid, Dr. Rohland argues that a certain degree of alkalinity is necessary in order that the protection may be efficacious. Further, he attributes to the colloidal nature of the cement the strong adhesion between concrete and iron, the plasticity, water-tightness and fire-resistance of concrete. The colloids envelop the iron as well as the particles of aggregate, and adhere strongly; plasticity is due to that of the colloids; water-tightness is secured by using such a proportion of cement as will produce sufficient colloidal matter to fill the voids; and resistance to fire is partly attributable to colloids.

THREE FORKS CEMENT CO.

The Three Forks Portland Cement Co., Trident, Mont., has asked for a change of venue from Park county to Silver Bow county in the case of Frank Romeo against the cement company, in which damages to the amount of \$25,000 are sought by the plaintiff, who, it is alleged, lost a leg through the negligence of the defendants.

EDMONTON CEMENT MILL

The Edmonton Portland Cement Company, Limited, Marlboro, Alberta, Canada, we are advised, was forced to shut down on account of the European war.

CHICAGO CEMENT RATES SUSPENDED

Proposed increases in freight rates on cement in carloads from eastern Pennsylvania by rail and lake to Chicago, Duluth and other western points were suspended to-day by the interstate commerce commission until Nov. 17. The increases range from 20 to 72 cents a ton.

The Crescent Portland Cement Co., Wampum, Pa., has ordered a 200 hp. 480 volt synchronous motor.

HIGH-WATER MARK FOR LIME

The manufacture of lime in the United States in 1913 broke all previous records, the production amounting to 3,595,390 short tons, valued at \$14,648,362, according to R. W. Stone, of the United States Geological Survey. This was an increase over 1912 of 65,928 tons in quantity and of \$678,248 in value. The average price per ton in 1913 was \$4.07, as compared with \$3.96 in 1912 and \$4.03 in 1911. While Pennsylvania is the largest producer, the output of this state is only 2.36 per cent of the total, indicating the wide distribution of the industry; in fact, forty-four states reported to the Survey a production of lime in 1913.

Lime used in building operations represents nearly a third of the total output, but large quantities are sold to chemical works, sugar factories, tanneries, etc., as well as to farmers for broadcasting on agricultural land.

Stop Shoveling Your Profits Away



Get the Time-Saving, Substantial, Reliable, Economical Van Duzen Mixer, with or without side loader, used by hundreds of large and small contractors. Capacity 50 to 80 yards per day. Both the Price and Cost of Operation will surprise you.

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Champion "Lightweight" Mixer

Hundreds of them now being used—every one proving satisfactory—owners would not part with them for twice what they cost.

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"Highway
Special"

with

3H.P. Mandt
Engine



Low Loading Measuring Hopper gives this MIXER the speed of a side loader.

A Batch of "40 Times Mixed" Concrete a Minute

For long hauls over rough roads this outfit can't be beat—high wheels with wide tires, standard wagon track.

Hoist or Power Loader Can Be Attached

Price is Lowest
Ever Made

Strongest Guarantee
Ever Written

Steel King

A LARGER MIXER
AT A LOW COST
BUILT OF STEEL

1000 pounds less material to pay for and drag around.

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THE AMERICAN CEMENT MACHINE CO., Inc.

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"Veelos" Balata Belting is the strongest belt known to engineers, having a tensile strength of more than 9000 pounds to the square inch.

This belt is especially made for the hardest kind of service, such as cement mills, stone crushers, gravel plants, etc.

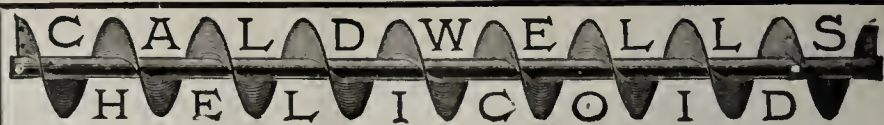
It is waterproof, you can run it in water or in the rain, without doing the least injury to the belt.

It does not stretch or shrink, you need not lose time and money in shortening this belt.

Every foot guaranteed, money refunded if not satisfactory.

Write for samples and prices.

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HELICOID Screw Conveyor is heavier, stronger and better made than any other. Requires fewer repairs—no lapped and riveted joints to come apart—flight all one piece. Special hangers, bearings and boxes for cement work. If you have anything to do with the manufacture of cement, you should write for our No. 38 Catalogue.

Elevating, Conveying and Power Transmitting Machinery.

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We make a specialty of
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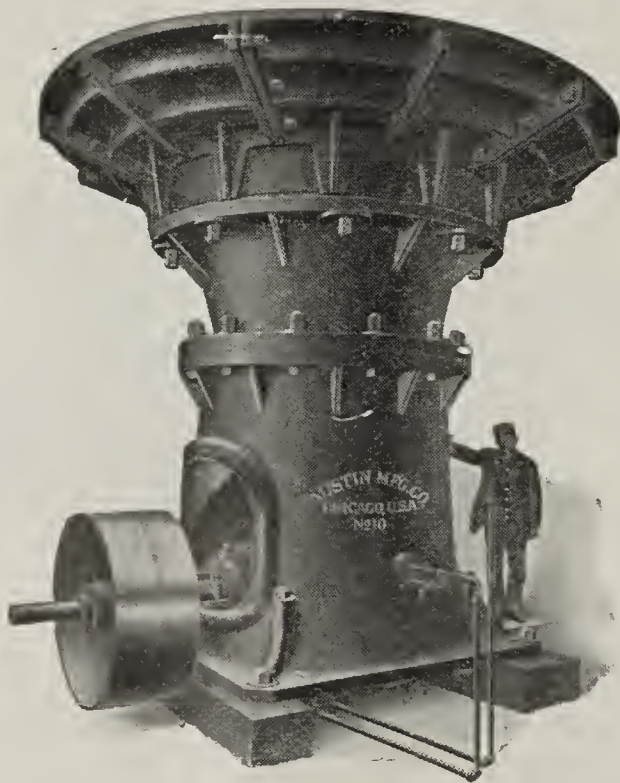
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Gilmore's Needles, Cement Moulds, Vicat Apparatus,
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The World's leading Ore and Rock Crusher. Its many superior qualities and mechanical advantages have won the highest reputation amongst Mining Engineers and Quarrymen.

Made in NINE sizes with capacities from 50 to 5000 tons per day. Smaller sizes can be mounted as Portable Plants. Thousands in use.

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Granite Brick Like This Pay \$5 to \$10 Profit a Thousand

Granite, marble, felspar, any kind of aggregate in fact, exposed in all its natural beauty and color on the face of cement brick and blocks without the use of chemical or acids.

Made on this Helm Press
under 80,000 pounds pressure.



It will tell you all about Helm presses which make granite finish brick and block. Merely sign and send the coupon now while you think of it.

The texture may be coarse or fine. The face is readily waterproofed and is even stronger than the body of the brick or blocks. These brick are selling for \$15 to \$30 a thousand. Full instructions for making this product are furnished free with the Helm Press. This grade of cement brick and blocks is turned out very rapidly on this machine. Helm Presses are built in different sizes to operate by hand or power with no tamping required.

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CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for \$1.00;
all other countries, \$1.00 per year.

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CHICAGO, OCTOBER, 1914

CONFIDENCE

Your confidence in your product is evidenced by
your advertising. Your confidence in your country
is evidenced by your continued advertising in the time
of the "so-called uncertainty.""So-called uncertainty" is a local issue. There is no
uncertainty in the West and Northwest, where the
largest grain crops ever known are now approaching
harvest. There is no uncertainty in the East, where
the mills are getting busier than ever before.The war scare of Europe is a bugbear for the timid
only—because the hundred million people in the
United States are going to continue to produce and
consume just the same as though a sword had never
been drawn.The American people are the most adaptable people
on earth. In a fortnight we readily adjust ourselves
to conditions.And every adjustment makes new things and new
uses for old things. What we formerly imported we
will now produce, because a demand has already been
created and must be supplied.Those manufacturers and producers who instill the
greatest amount of confidence in the minds of the
public will reap the greatest rewards.If your product is known, through advertising, to
the consuming public, keep it so. Keep up that con-
fidence the public has in you and your product.If the price of your product has not been advanced,
now is the golden opportunity to say so—an im-
pression made at an impressionable time is the most
lasting.If you have been obliged to advance your prices,
explain why—you will always find the American buy-
ing people reasonable.Keep up the momentum your advertising has gained.
Do not let the public forget you or your product. (And
they surely will if you let up in your advertising now.)And do not forget the public has not stopped con-
suming. Before the Civil war the salt we used was
largely imported. The difficulty in securing imports
during the war hampered many industries, including
hog packing, which was then located largely in Cin-
cinnati, St. Louis and Milwaukee. A resourceful
Yankee set about to produce salt at Saginaw, Mich-
igan, and was successful. His success, followed bythat of others, placed the United States upon a new
and independent basis so far as the use of salt is con-
cerned. In 1907 this country was wondering about
the effects of the money panic. A prominent Eastern
publisher made a flying tour of the states. He talked
with bankers, manufacturers, merchants and with
everyone to whom he could talk. He found condi-
tions sound—only a little lack of confidence. Upon
his return East he authorized a large expenditure for
the purpose of advertising his publications and the
advertising in them. He created confidence in the
minds of the readers and in the minds of his adver-
tisers—and incidentally reaped rich rewards.

CEMENT IN SOUTH AMERICA

The Vulcanite Portland Cement Company has been
selling in the South American field for about twelve
years. The following views, therefore, of Albert
Moyer, manager of the sales department of that com-
pany, as given to a representative of The Engineer-
ing Record, are particularly interesting:The American manufacturer of cement has now the
greatest opportunity ever afforded him to capture, dom-
inate and retain the South American cement market.
Heretofore German, English and Belgian cements
have been chiefly used—the German shipments alone
to the whole of South America in 1912 amounting to
5,746,000 barrels. While in normal times it is not
easy to sell against the well-established European
brands, the present emergency forces the countries to
the south to buy from us.American cements are not unknown in the South
American states, particularly in Chile, Peru, Vene-
zuela and Colombia. Lack of direct shipping facilities
to Argentine and Brazil has prevented as rapid prog-
ress there against European competition.Fortunately the industry in the United States is
ready for the emergency, since the Eastern mills,
which are chiefly concerned in the present situation,
are over-equipped on the basis of the present domestic
demand. While almost any price might be obtained
for American cement in the present juncture, the
manufacturer must bear in mind that the emergency
must not be used for the exploitation of the South
American customers. We should aim to stay per-
manently in that market, to build up a steady trade
and not give our new customers an immediate reason
for returning to English and German brands when the
war is over. While a price higher than received re-
cently is justified, it would be well if all cement were
laid down at our seaboard at a price to give a reason-
able profit, the risks cost of doing foreign business,
etc., being all considered. Such a price would en-
able American manufacturers to hold their own against
foreign brands when they again come into the market.

SAND-LIME BRICK

Saginaw Brick Company, Saginaw, Mich., has fur-
nished 200,000 sand-lime brick for several new fac-
tory buildings recently built for the Bransfield—Bill-
ings Action & Supply Company, of Saginaw, who
are exceedingly well pleased with sand-lime brick.
Although their older buildings are built of clay brick,
they have used about 200,000 sand-lime brick on all
new buildings erected this year, paying a higher price
than clay brick could have been purchased for.CONCRETE for
PERMANENCE

The Hydration of Hydraulic Cements.

By Dr. F. Blumenthal.

(Translated by Dr. W. Michaelis.)

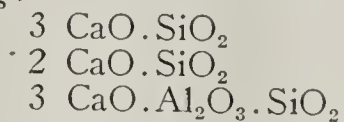
In 1824 the English bricklayer Aspdin invented a hydraulic mortar which he named "Portland cement." In time this invention has been improved upon so much that the commercial Portland cement of today is an entirely different product from the original article.

For a long time the name "Portland cement" was claimed by all kinds of commercial products of superior or inferior qualities until the Association of German Portland Cement Manufacturers defined the limits of composition by declaring Portland cement to be "a hydraulic mortar composed of not less than 1.7 parts by weight of calcium oxide to 1 part by weight of soluble silica, alumina and iron oxide combined, produced by fine grinding and intimate mixing of the raw materials, burning until beginning vitrification and subsequent fine grinding of the clinker."

This definition briefly describes the production of Portland cement. The points next to be considered are: What chemical compounds does the clinker contain, what changes do these undergo upon mixing with water, and how are the setting and hardening of cement to be explained?

Many experimenters have tried to solve these problems. Their efforts have been crowned with more or less success, so that the processes of sintering, setting and hardening are still open to discussion.

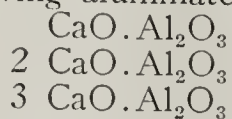
Le Chatelier declared the clinker to be composed of three minerals, whose existence he deduced from synthetic experiments. Their composition was supposed to be the following:



although he never succeeded in producing the first mineral by synthesis; calcination of the corresponding mixture invariably resulted in



However, S. B. Newberry claimed to have obtained the chemical compound $3 \text{ CaO} \cdot \text{SiO}_2$ by calcination in an oxy-hydrogen flame. Le Chatelier considered this mineral to be the most important element in the hardening of cement. Later experiments convinced him that also calcium aluminates occur in clinker and that these take an important part especially in the setting. By synthesis he obtained the following aluminates:



and declared the last of these three compounds to be present in cement clinker.

Toernebohm determined the composition of cement clinker by a study of microscopic sections. He regards the clinker not as a pure chemical product, but as an artificial conglomerate of four minerals which he termed alite, belite, celite and felite. These minerals were supposed to have the following composition:

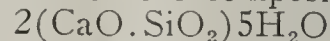
Alite = $x(3\text{CaO} \cdot \text{SiO}_2) + 9\text{CaO} \cdot 2\text{Al}_2\text{O}_3$. It is colorless, granular, forming plate crystals of slight double-refraction.

Belite = $x(2\text{CaO} \cdot \text{SiO}_2) + 3\text{CaO} \cdot \text{Al}_2\text{O}_3$. It does not occur as frequently as alite. Its color is yellowish opalescent, it is strongly double refracting.

Celite = $3\text{CaO}(\text{FeAl})_2\text{O}_3 \cdot 2\text{SiO}_2$. It is always of darker color than the other minerals.

Felite: Its composition is unknown. It occurs only in clinker containing a small percentage of belite. A colorless mineral, granular and strongly double-refracting.

In Toernebohm's opinion, the setting is brought on mainly by alite, which is decomposed by water. This mineral is supposed to be transformed into an amorphous mass, which partly crystallizes later on, and into a scale-like crystalline substance. The former is declared to be calcium hydro-silicate of the composition



with an admixture of alumina hydrate, while the latter is taken for crystals of calcium hydrate.

Also Hauenschield assumes the setting to be due to the formation of a colloidal mass which crystallizes in time.

Le Chatelier and Toernebohm are of the opinion that the cement clinker contains all lime in chemical combination, that the latter is liberated only upon addition of water and takes part in the hardening by formation of crystals. This opinion is shared by Erdmenger, who observed hardened cement to contain large amounts of calcium hydrate.

Similar results to those of Le Chatelier were reported by Newberry, who declared good commercial cement to be of the composition



According to his observations, tri-calcium silicate is a stable compound and hardens very well, whereas a compound with $3\frac{1}{2}$ molecules of CaO is no longer stable. However, he does not agree with Le Chatelier upon the calcium aluminates. He considers only the di-calcium aluminate to be possible, as even a compound with $2\frac{1}{2}$ molecules of lime proved to be unstable.

O. Schott's opinion differs from Le Chatelier's and Newberry's in as much as he declares tri-calcium silicate not to be a constituent of Portland cement clinker, because it showed invariably signs of expansion. By fusion in an electric arc-light furnace he obtained di-calcium silicate and mono-calcium silicate, of which the latter possessed no hydraulic properties. In his opinion, the cement clinker represents a solid solution of calcium oxide in di-calcium silicate with an admixture of di-calcium aluminate.

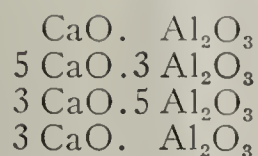
Zulkowski shares his opinion and declares the di-calcium silicate, upon addition of water, to be decomposed into mono-calcium silicate and calcium hydrate. By mere swelling of the former and crystallizing of the latter the hardening of cement is brought on. Such swelling of the mono-calcium silicate without hydration has been observed also by Bewzian, who agitated mono-calcium silicate with lime-water and examined samples of it under the microscope. Upon heating at 100 centigrade, however, it went back into its former crystalline state.

P. Rohland regards cement clinker as a mixture of lime, soluble silica and alumina. During the hardening process part of the lime combines with silica to calcium hydro-silicate, which forms a colloid, while lime is liberated hydrolytically, converted into carbonate of lime and thereby the cement considerably increased in strength.

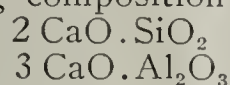
E. Fordis believes a reaction between free silica and free lime to be possible in cement with the assistance of alkalies which he considers invariably to be present in cement. However, according to Newberry's experiments, such action on the part of alkalies is impossible.

Lately, very interesting results on the constitution of cement clinker were published by E. S. Shepherd and G. A. Rankin. They proved by means of fusions that two compounds between lime and silica are pos-

sible, namely, the meta-silicate ($\text{CaO} \cdot \text{SiO}_2$), fusing at 1512 centigrade and converting into wollastonite at 1190 centigrade, and the ortho-silicate ($2\text{CaO} \cdot \text{SiO}_2$), which crystallizes in four different forms. They did not observe a tri-calcium silicate. The following four compounds between lime and alumina were obtained by them:



Only the last-named aluminite is supposed to be present in cement. Both investigators are working at present over compounds of the ternary system $\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{SiO}_2$. These experiments, however, have not been concluded as yet. Shepherd and Rankin attribute the following composition to cement clinker:



CaO dissolved in $2 \text{CaO} \cdot \text{SiO}_2$.

W. Michaelis sen. studied principally the process of hydration. He considers the clinker to be a solid solution of lime, silicic acid, alumina acid and iron acid. Upon addition of water he observed formation of colloids and crystals. The former turned out to be composed of calcium hydro-silicate, while the crystals were

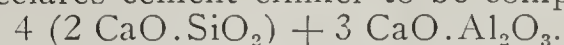
observed under the microscope the formation of fine needle-shaped crystals and hexagonal plate-crystals which radiated in large numbers from the surface of the grains of powdered cement. Ambroun observed that the needle-crystals of adjoining grains were intimately interlaced.

After a few days, he observed, in addition to these two kinds of crystals, the formation of a third group of crystals which likewise belonged to the hexagonal system and obtained considerable size. Besides these crystals, a colloidal mass was formed which cemented the crystals together.

Ambroun, however, did not throw any light upon the composition of these crystal and colloidal formations. This was attempted by Keisermann, who invented a staining process and succeeded in giving the following explanation:

The fine needle-crystals and the colloidal mass consist of hydrated mono-calcium silicate, the large hexagonal crystals are calcium hydrate and the small hexagonal plate-crystals are hydrated tri-calcium aluminite.

He declares cement clinker to be composed of:



Method of Operation.

The staining process employed by Keisermann has been criticised by a number of cement experts. Wetsel declared the staining process to be an important aid in the investigation of the constitution of Portland cement. P. Rohland designated it as the right way for the identification of the products of hydration forming in cement.

Before we began to investigate the composition of cements, we endeavored to complete this staining process which is based partly upon the formation of lacquer with certain organic dyes, and partly upon surface staining; that is to say we examined thoroughly the influence of these stains upon the various constituents of cement.

The problem consisted in proving under the microscope at the same time, the existence of alumina, calcium hydrate and silica in alkaline solution. A reliable reagent for calcium hydrate and alumina hydrate was found to be a lime-water solution of anthra-purpurine. (A similar solution prepared with potassium or sodium hydrate cannot be employed because the alkalis form soluble stains which cannot be fixed upon the precipitate.) Alumina is stained brownish-red; calcium hydrate and its compounds, however, in the absence of alumina, distinctly red. Anthra-purpurine, therefore, is a safe reagent for calcium hydrate.

An excellent reagent for alumina in alkaline solution proved to be patent-blue; this stains alumina or alumina compounds blue, if they are freshly precipitated; but does not stain calcined alumina or clay or similar compounds, or alumina in acid solution.

Anthra-purpurine, therefore, is a safe reagent upon calcium hydrate in the absence of alumina, while alumina can be detected even in the presence of calcium hydrate, by patent-blue.

In order to prove the presence of silica, methylene blue was used. A neutral solution of this stain was absolutely indifferent towards calcium silicates as well as calcined silica or quartz silica. Colloidal silica, however, precipitated by dialysis, was stained. Furthermore, silica, precipitated from its compounds by acetic acid, was likewise stained dark-blue.

The reagent for silica in chemical combination, therefore, is methylene-blue in acetic acid solution, and for free silica, neutral methylene-blue.

As reagent upon ferrous oxide compounds slightly acidous potassium ferri-cyanide solution was used, and upon ferric oxide compounds slightly acidous potassium ferro-cyanide solution.

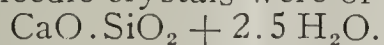


No. 1. Portland Cement. The Fine Needle Crystals Are Composed of Calcium Silicate.

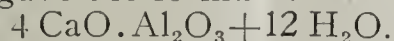
compounds of lime, tri-calcium aluminite, tri-calcium ferrite and calcium sulphate. He declares the formation of colloids to be the main cause of the hydraulic hardening.

W. Muth carried on a series of observations on the action of water on cement by agitating powdered cement with water. Samples of the cement treated in this way were examined under the microscope. He observed the formation of thin needle-crystals, hexagonal plate-crystals and a colloidal mass. The walls of the flasks were heavily lined with hexagonal crystals composed of calcium hydrate. Of the same composition were the small plate-crystals.

Le Chatelier studied the process of hydration with the aid of the microscope by allowing chemicals to act upon microscopic sections. Upon adding lime-water he observed very fine needle-shaped and hexagonal crystals. The needle-crystals were of the composition



In addition, he observed the formation of sphaerolites which he gave the formula:



To H. Ambroun we owe a series of very interesting observations. He mixed a small amount of finely ground cement clinker with little water and very soon

The Hydration of Portland Cement

The first efforts were directed towards obtaining a clear insight into the process of hydration of Portland cement. For this purpose, a rotary kiln clinker of standard manufacture was used.

The preparation of the microscopic slides required extraordinary care. It was found necessary to make at least twenty-five microscopic preparations of each material under observation, which had to be examined at the same time in order to avoid errors.



No. 2. A Large and Several Small Crystals of Calcium Hydrate in Portland Cement After Four Weeks.

A small part of the very finely pulverized sample was stained with a drop of water and protected with a cover glass, the rim of which was sealed with molten paraffine and the latter, furthermore, covered with lacquer that dried quickly and contributed to sealing the preparations hermetically. Thus treated, the slides can be kept for several months without drying out. It was not permissible to close the rims of the cover glasses merely with fat, as otherwise customary, because they had to be opened frequently later on in order to let the stains act upon them.

Several cement experts declared that the processes going on during these observations were not identical with those during the hardening of cement, because a large surplus of water was employed and the process of hydration proceeded in a different way.

This objection, however, is not justified. Ambroun, for instance, used very little water in making his preparations. He succeeded even by mere breathing in obtaining the characteristic crystals on the surface of the grains of clinker. Moreover, a surplus of water can never disturb the decomposition of the clinker; on the contrary, Michaelis demonstrated that the clinker is decomposed the more thoroughly the larger the amount of water added to it.

Observation of the Slides During the Process of Hydration

The following observations were made on the slides prepared in the manner described above:

As early as after two or three hours the formation of numerous short, thick needle-crystals became visible, which, upon closer investigation, proved to be plate-crystals standing on edge. Many grains of clinker were completely surrounded by them. Almost at the same time, a large number of very thin sharp-pointed needle-crystals developed, which were difficult to observe in the beginning. Some of these radiated from grains of clinker, while others were separated from them and formed isolated groups of crystals.

The needle-crystals first observed continued to grow

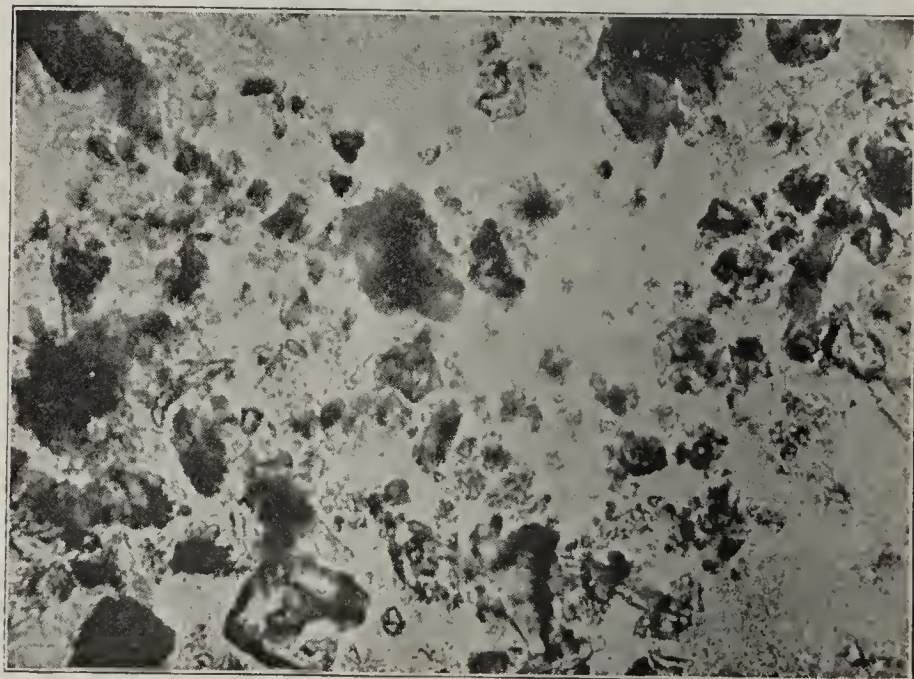
in length and width. Many of them took ultimately the shape of flat hexagonal plate-crystals. At the same time, the fine needle-crystals grew. After a number of days, clusters of crystals became especially frequent. These needle-crystals had a very small diameter, but could be detected without difficulty.

After three or four days, in addition to the former crystals, large hexagonal crystals could be observed (In the beginning of their development these are easily mistaken for the plate-crystals formerly mentioned). These grew in many preparations until they obtained considerable size and contained enclosed within them grains of clinker and small crystals. Figure 2 shows a large and several small crystals of this kind. This illustration represents Portland cement after four weeks. The remaining products of hydration, which we likewise present on this slide, are less visible in this cut, because the microscope was focussed so that the large crystals showed off at the greatest advantage. The same applies to all subsequent illustrations.

In older preparations, which, however, were not dried out, the large crystals showed fissures in time; subsequently they disintegrated and ultimately dissolved at the expense of a colloidal mass which developed gradually. Slides which were not completely protected from access of the air, showed corrosion and final dissolution of the crystals much sooner. In the latter case the absorption of the crystals led to the formation of new groups of crystals which were composed of calcium carbonate; these were observed in time at almost all preparations and formed in large numbers, especially at the edges of the cover glass, as soon as air had access.

In the course of five days, frequently even sooner, precipitation of a colloidal mass became distinctly noticeable. It could be observed at first as small drops which developed especially along the fine needle-crystals, but soon spread over the whole preparation.

Figure 3 illustrates Portland cement four weeks old, in which the colloidal mass is distinctly visible; it is made up of numerous small drops covering the slide. In addition to this, plate-crystals and fine needle-crystals are visible.



No. 3. Portland Cement Four Weeks Old. The Colloidal Mass Appearing as Small Drops Consists of Calcium Silicate.

It must be mentioned that it was frequently observed that in preparations in which plate-crystals were perfectly developed the formation of needle-crystals was neglected and vice versa. Furthermore, it was a striking fact that in preparations in which needle-crystals were rare the colloidal mass was

formed more rapidly and was found to be more comprehensive than in preparations which showed well-developed needle-crystals. This alone admits the conclusion that there must be something in common between these two formations with regard to their composition.

Also, Muth made the observation that the colloidal mass formed at the expense of the needle-crystals, if he treated the clinker with varying amounts of water. Possibly this explains the difference in the behavior of the various preparations. This, however, can not change the general aspect of the process of hydration because, as formerly mentioned, a large number of slides were made at the same time from each substance under examination, which made all probable conditions possible.

(To be continued.)

SAND-LIME BRICK

J. I. Buchanan

Sand-lime brick have met with much favor, according to government reports. Production has increased very rapidly, the factories are distributed pretty evenly over the United States from the Atlantic to the Pacific coast and the product has taken its place in the front rank of high grade building material, and is one that will be appreciated more and more as time demonstrates its good features, such as substantial durability, beauty, and economy, also being fire and water proof.

Most of the brick are used in their natural pale gray or white color and where used for the construction of expensive buildings with red and green tile roof the striking color effect makes a beautiful and pleasing contrast. Sand-lime brick, owing to their comparative resistance to moisture, retain their color and fresh appearance much longer than materials which have greater absorption; and they are easily cleaned when discolored. Beautiful and durable color effects can, however, be produced by the mixing of lime-proof coloring material, and these are especially effective when used as trimmings for the white brick buildings.

Fire Brick Purposes

Although not made as an exclusive fire brick some have been used for fire brick work with most flattering results. Brick thus used were without any special treatment to make them more refractory, such as is customary when making the usual fire brick but were the regular building stock. At the burning of a large factory at Cedar Rapids, Iowa, the heat was so intense that wheels of the freight cars on a siding near by were melted down. Yet a pile of sand-lime brick inside the building was not injured. In another case where sand-lime brick were used as a part of the lining of the furnace in a lime kiln a disastrous fire occurred. The melted iron braces ran down on to the brick; yet the sand-lime brick were uninjured. The side and rear walls of the, 10-story Monadnock building, standing next to the Palace hotel, San Francisco, passed through the earthquake fire practically uninjured, although directly in the path of the fire. The brick were sand-lime material. In one furnace test the heat ran up to 3,000 degrees F., yet the brick were not destroyed. In another test, where sand-lime brick was built into the lining of a furnace with high grade refractory fire brick, the only way one could be distinguished from the other when the furnace cooled was by the size, the fire brick being considerably larger.

Durability, Strength and Absorption

Every one who has looked into the matter thoroughly, either from a chemical or practical standpoint, is satisfied that the calcium silicate bond is almost indestructible under any conditions to which a building brick is likely to be subjected; that it grows strong with age, changeable and severe climates. About

two thousand of the brick were used experimentally by the government in the repairs of locks at Dam No. 1, Monongahela River, at a point where the action of frost and the wear by rubbing of boats entering and leaving had been very hard on sandstone masonry; after 8 months the brick were found to be in excellent condition, where the iron-bound corners of the boats (many of which are of 1,000 tons capacity) had struck the brick, they were scored in places to the depth of an inch, but were not otherwise damaged.

Bricks submitted to a freezing and thawing test were first submerged for 24 hours; absorption 9 per cent; then frozen 60 hours to 5 degrees below zero, then thawed out quickly at a temperature of 260 degrees, then used as a fire face in a furnace, but under this severe test showed no signs of cracking or deterioration. Freezing and thawing will not injure the bond.

Literally hundreds of tests by different parties of the crushing strength of sand-lime brick have been made and it is uniformly found to be very high. The German government's standard for sand-lime brick runs a little under 2,000 pounds to the square inch. It is not uncommon for the crushing strength of this brick to be 7,000 pounds per square inch, therefore, the factor of safety of an ordinary wall made of sand-lime brick is much in excess of the building requirements. The matter of absorption is largely contingent upon the methods of manufacture. The grains of sand themselves absorb practically nothing at all, therefore, whatever moisture is taken up depends upon the voids between the grains of sand. Proper manufacture supplies material for filling these voids then subjects the brick to extreme pressure which makes a practically non-absorbent brick.

Sand-lime brick are simply sand and lime accurately proportioned, thoroughly mixed, pressed with tremendous force into shape, and then hardened in a steam-tight kettle, with hot live steam, 110 pounds pressure to the square inch. The result is a perfect building stone with more resisting power than Nature's sand stone. The great freedom from dampness makes a sand-lime brick building warmer in winter healthier all the year round. The bond between the mortar and brick shows unusual strength. Sand-lime brick do not absorb moisture and may be laid with a thick or thin layer of mortar, with no preparation of any sort. Furthermore, the mortar clings thoroughly to them, regardless of their smoothness as they are identical in nature to the mortar itself.

Twenty-four hours from the sand hill to the mason is all that is necessary, in time, for the production of a completed brick, and the longer they stand the harder they become.

MONROE GRAVEL PLANT

The Louisiana Sand and Gravel Company, Monroe, Louisiana, with a capacity of 50 carloads of road gravel, washed sand and rock per day, is now shipping on an average of 37 cars per day, 15 cars of the daily output going to Caddo parish and shortly Bossier parish will also come in for its share, as it will be used in constructing good surface roads in that parish. This company also ships large quantities of sand and gravel to Mississippi, Arkansas and Texas.

The company has spent approximately \$125,000 erecting an immense washing and loading plant, building four miles of railroad, connecting the gravel pits to the main line of the Vicksburg, Shreveport and Pacific railway, and purchasing one of the largest steam shovels ever manufactured. It was made by the Marion Steam Shovel Company and is giving splendid service. This company has been in operation about two years.

The Decorative Possibilities of Concrete.

By C. W. Boyton and J. H. Libberton.

(Continued from page 240)

Another prominent figure in the manufacture of decorative concrete stone is the Economy Concrete Company of New Haven, Conn., which has begun at home to demonstrate the possibilities of concrete for furnishing the ornamentation for buildings of other material. Some of the most interesting work which this company has done, and that which it prizes most highly because of the personal interest, can be seen by all those who visit the home office, where the fire-



Fig. 49. Fireplace Detail, Economy Concrete Co., New Haven, Conn.

place is composed principally of ornamental concrete stone (Fig. 49). The figures above the mantel are molded after the various workmen about the plant, with the exception of the one at the far right, who represents transportation. The other figures represent in their order (1) the draftsman laying out the plan, (2) the sculptor working over the pattern, (3) the laborer pouring the concrete, and (4) the workman putting the finishing touches on the surface and correcting any flaws caused by removing the forms.

The work is all cast in solid and uniformly proportioned concrete without special surfacing, using wooden or plaster molds. Where necessary, glue molds are employed for the under-cut work. This, of course, gives a rather smooth surface and is the only criticism which could be made of the product.

The work of this company has favorably impressed such architects as Cram, Goodhue & Ferguson, who designed a number of buildings at West Point, including the gymnasium and cadet barracks (Fig. 50). In these structures all the stone work above the first story has been cast by the Economy Concrete Stone Company. The close scrutiny which the government gives the building materials it uses is well recognized and the use of concrete stone in so important structures is a strong recommendation for the material. On the interior, all the stone decoration is of concrete, including appropriate relief panels of athletes at various sports (Fig. 51).

The chapel at St. Paul's Church at New Haven, Conn., has furnished another opportunity for this company to demonstrate the superiority of its product, as concrete stone has been used for decorating the old granite structure over 75 years old (Fig. 52). Just lately, the opportunity presented itself to brighten up

the old building with concrete, and how satisfactory has been the result is self-evident.

It should make no difference whether the stone trimming is artificial or natural, the end achieved is that upon which we should pass judgment. In reality, it matters not whether the aggregate in the concrete has been bonded by nature, or by the hand of man with Portland cement as the binding material. So far as permanence is concerned, concrete has already proved beyond a doubt its superiority to many of the natural stones.

St. John's Church is built of a local trap rock which is of a natural gray surface (Fig. 53). But mingled in through the walls are many stones which are rusted, giving a weathered effect, which unobtrusively accentuates the concrete ornamentation, carried even through the tracery of the windows and the tower, and is much in evidence on the interior.

Another instance of concrete applied to ecclesiastical architecture is found in the Broadway Presbyterian Church of New York City (Fig. 54). The natural stone walls of the building are of New York gneiss laid up in random ashlar, and all the trimming, including the window tracery, is of concrete stone. This was cast in sand molds by the Onondaga Litholite Company of Syracuse. The aggregate used for manufacturing this particular stone is made from Gouverneur marble, a hard calcite product from northern New York. This flinty material in crushing, breaks into sharp angular pieces, which are graded into several sizes, depending upon what work they are to enter. After removal from the sand molds, the concrete is carefully cured and then tooled and surfaced by machinery. The surface obtained is identical with natural stone—but oftentimes is superior to it, because of its greater ability to resist the action of the elements. Conclusive evidence of this characteristic is to be found in the old sandstone decoration on the Königsbau at Stuttgart, erected about 30 to 50 years ago. The upper cornice was ornamented by a number of large figures which began to disintegrate, making replacement of some of the parts necessary from time to time. As a final remedy, the officials proposed duplicating the figures in concrete. The decision was



Fig. 50. Gymnasium, U. S. Military Academy, West Point. All Trim Above the First Story of Concrete Stone.

arrived at after inspecting several artificial stone figures which had shown practically no deterioration after 20 years of exposure to the elements. The surface of the new figures was tooled after coming from the forms so that they were identical in texture with the discarded sandstone models.

The Universal Portland Cement Company attempted something unusual in the construction of its new office building at Buffington, Ind. (Fig. 55). The building is of plain faced concrete blocks with the monotony broken up by the insertion of smaller squares and bands. The surface is further brightened by a ground surface finish which exposes the limestone aggregate and adds life.



Fig. 51. Interior of Gymnasium, U. S. Military Academy, West Point.

In Boston, an imposing memorial showing tooled surface has been erected in Post Office Square (Fig. 56). This pleasing combination of cast stone with monolithic concrete was erected by Emerson & Norris and designed by Messrs. Peabody & Stearns, all of Boston. The monument is supported on reinforced concrete piles and the central portion is faced with cast stone, but the shaft was cast in place and afterward bush hammered to match the ornamentation. For aggregate, a mixture of granite, white and black marble, was used, which when exposed gives a sparkling and contrasty surface, displaying the combined characteristics of the individual materials.

The writers, not being architects, have dealt somewhat sparingly with the subject of architectural and decorative possibilities of concrete and have rather depended upon the illustrations to indicate the purpose of this paper. After all, architecture and architectural decoration is a peculiar study. On the one hand, we have those who contend for close adherence to the ancient styles of architecture, and on the other hand, we have many brilliant minds who have achieved wonderful results and designed some of our most pretentious structures along entirely new lines, yet without voluminous criticism from those who consider themselves authorities. However, since this paper has dealt more particularly with the architectural side of concrete, it is perhaps fitting that we close with a quotation from Oswald Hering, who has made a study of concrete and its architectural and decorative possibilities, and who, by the way, is a son of Rudolph Hering, an honored member of the Western Society of Engineers:

"Concrete can be easily and rapidly manipulated. It

is less expensive than either clothed steel or masonry construction alone; it does not deteriorate with time and it is practically fire and waterproof. It grows in strength for a considerable length of time, and after having attained its ultimate strength, it never weakens, consequently, by its use, lighter, cheaper and more durable structures may be erected than with any other known materials."

Regarding concrete stone he says:

"The time would seem to be not far distant when concrete will very largely supplant marble and stone where castings are practical. These should not be termed 'imitations' of stone, for the ingredients are largely the same as are found in real stone. Nature's process of employing time and gravity has simply been superseded and accelerated by man's mechanical ingenuity."

Discussion.

President Reichmann: We have had the pleasure of listening to a very interesting paper this evening. Perhaps Mr. Boynton would like to start the discussion.

Mr. Boynton: We found many points of interest in preparing this paper. The work of the Economy Concrete Stone Company is of particular interest because they have developed a type that they insist on making one way; if the architect likes it he can use it, if not, he can leave it alone. I think that is one reason why they have succeeded so well in getting a product that is uniform and really desired by the architect because it is dependable.

The Economy Concrete Stone Company cast their product in the different molds necessary to get the lines desired and then rub the product with rubbing stone, carborundum, or whatever is necessary to expose the aggregate product. When I last visited their plant they had a large piece that they were casting for a Government hotel at Panama. The Government holds this company in high esteem, because of the quality of the stone they are producing.

The work that the Emerson & Norris Company are doing is wonderful in that they have practically displaced stone for entrance decoration in Boston. There are block after block of apartments in which all the entrance work and all the stone trim from the ground up to the window-sill, on the first floor, is cast stone or concrete stone rather than natural stone. Natural stone is no longer "in the running" where other stone



Fig. 52. Chapel of St. Paul's Church, New Haven, Conn. Window Tracery of Concrete Stone.

can be obtained, because the latter is more uniform; it is more economical, because it can be cast in practically the shape and form required and thus reduce the cost of cutting to a minimum. This does not mean that it is sold cheaper because it is less attractive or less desirable (it is really more attractive and more desirable), but being influenced by the cost of the product it results in economy.

The Germans have been replacing with concrete for twenty years or more, all the old stone work that has deteriorated. The stone work referred to as being



Fig. 53. St. John's Church, Hartford, Conn. All Trim and Tracery of Concrete Stone.

now replaced with concrete was mentioned last December at the annual meeting of the National Association of Cement Users. A gentleman from Germany was in this country at the time, who had some lantern slides showing work in which they were replacing figures on the top of some of the German Government buildings. Some of the pictures showed where they were replacing with concrete the old sections of heavy stone columns which had deteriorated, retaining the form and texture and color. He said it was not at all uncommon to do that.

Q. Where cutting of the cast stone is necessary, can as delicate work be done as on the natural stone, or is there a tendency of the material to spall or crumble under the chisel?

Mr. Boynton: I believe good concrete will not spall as readily as natural hard stone. You doubtless have noticed some effects of concrete blocks (for instance, such as Mr. Hering referred to) where sufficient water had not been used in mixing the concrete, and where the blocks had been improperly cured, etc. That results in a crumbly product and chiseling is impracticable. In fact, the ends could be rubbed off with the finger. But a well-made concrete product can be worked in a manner similar to that of good building stone. The way it will cut will depend somewhat on the age and the size of the aggregate. If made of large aggregate it would require more time, so as to resist the tendency to break through the aggregate at a point not broken by the chisel, but after it is properly aged the size of aggregate makes no difference. If a product were to be chiseled it would naturally be made of finer aggregate; that is, $\frac{1}{4}$ to $\frac{1}{2}$ in. rather than $1\frac{1}{2}$ in. stone. There is no danger of properly-made concrete spalling or crumbling after it has reasonable or proper aging.

President Reichmann: About how old must concrete be before it can be worked with a chisel?

Mr. Boynton: If necessary, and the concrete were cured under steam it could be chiseled in a week's time, if made with that in view, but under ordinary

circumstances with normal aging under normal temperature and with water only, I think it could be chiseled safely in thirty days.

Q. I would like some information as to how the ornamental tiles are applied. Are they placed in the forms before the concrete is poured, or, if not, are blanks for them provided, and the tiles subsequently inlaid? Also, is any material or backing or mechanical bond for them necessary?

Mr. Boynton: It is usually the practice to put a blank in the form, outlining in a general way the shape of the figure or the tile that is to be set in, having the blank the same depth as the piece to be set plus a light mortar backing. Then with careful setting, thorough moistening of the concrete, and careful placing of the tile in the proper mortar, it adheres firmly.

Q. What material was used in stenciling the interior of the building that represented the lattice? Was it paint?

Mr. Boynton: I presume it was. There are a number of formulæ that will produce good paint for painting on concrete, even on green concrete. Any form of linseed oil paint can be used, if the concrete is thoroughly aged. But we never know exactly when it reaches that point and we are apt to want to decorate the surface before that time. With the use of the proper formula it is perfectly safe to paint concrete as soon as it ordinarily dries out, say in thirty days' time.

Q. Must the paint be something special?

Mr. Boynton: Yes, but it is an inexpensive paint. Linseed oil on concrete may prove troublesome and have to be removed.

Mr. Stineman: The statement is made in the paper that pleasing architectural effects may be made in concrete with very little or no additional cost. That is something which engineers should bear in mind,



Fig. 54. Broadway Presbyterian Church, New York City.

because many of them are inclined to the belief that anything which looks well will cost too much. As a result they erect buildings which are nothing but walls with holes in them, and bridges and structures that are unsightly from an architectural standpoint. They say, "We will put up the structure so it will hold and do the work, and never mind how it looks." Yet with the same or a little more money a pleasing architectural effect might be had. I notice among the illustrations several viaducts in this city, plain in surface or plain in line, which have a pleasing effect be-



Fig. 55. Office Buildings of the Universal Portland Cement Co., Buffington, Ind.

cause some architect or some man who understood architecture designed them. I would not go so far as to say that engineers should be architects or should make a study of architecture, but I believe engineers should either learn something about architecture or else, in the case of structures which are built in places where people must look at them for years and years, engage an architect to design for them, if they are not able to do it themselves.

President Reichmann: I think that is a very good point. It is only within the last few years that engineers have ceased using most of their time developing new theories for the engineering profession. We are now spending a little more time developing architectural effects of our designs. Years ago, any attempt in the line of aesthetic design in connection with factories was immediately cut short; the owner would not allow the engineer to put anything on the structure in the way of ornamentation, because it would cost a few dollars. But we are now approaching the time when there is more willingness to give the structure attention from an aesthetic standpoint. I believe the engineer is capable of doing this, but heretofore he has not been permitted to do it. There is a great difference in the factory of today and the one built twenty years ago. At the present time, the light and the general features are thoroughly considered before the work of planning is started.

Mr. Boynton: Regarding the work of Mr. Squires in New York, there is one point I might mention as to getting the decorated ceiling effect by using inverted sand molds for the forms. We tried to secure a photograph of the finished ceiling, but had to give up the idea after making several efforts, because of the difficulty in getting back far enough and securing the proper lighting.

In that work Mr. Squires has gone a step forward, I think, in that he will get all the strength he requires through the beams between the decorations. He will also do away with the plain ceiling at a cost that will be taken care of by the cost of a plain ceiling. He says the cost of building such a ceiling is practically nothing, over the plain ceiling. He saves weight with his structure—saves all the way down the line—and

he has a decoration when he gets through that is attractive. Those things are well worth our consideration, and doubtless many of us in our every-day work will see how by study we can get some decoration or pleasing effect without adding materially to the cost; possibly decreasing the cost. Mr. Squires is an architect and not an engineer; that is, he is practicing as an architect, and his work has been confined very largely to residences and apartments. But the same principle can be used in other buildings where a decorated ceiling is desired or there is any desire or need for breaking up the monotony of a ceiling. The cost of such work will doubtless be a little more until we become accustomed to it, or until we have men trained to making the blanks.

One thing that has kept us back and interfered with the proper development of concrete, is that the man who makes the initial expense must necessarily be at more expense than the one who comes after him. We find this in building houses. For instance, in building houses at Gary, the first year's houses cost much more than the second year's work. The saving the second year was astonishing, and it was due to the fact that a trained organization had been developed the second year, avoiding delays and in many ways effecting savings.

The point we have tried to bring out in the paper is that in concrete we have a material from which we can get results. The only real lesson we have tried to teach is that in concrete there are great possibilities for beauty, and this beauty can be brought out by giving a little thought and study to the matter.

(Reprinted from Journal of Western Society of Engineers).



Fig. 56. Angell Memorial, Post Office Square, Boston.

Results Secured in the Use of Hydrated Lime in All Kinds of Concrete Construction

By Robert S. Edwards

In a great many parts of the United States at the present time, hydrated lime has become very favorably recognized and in considerable demand as a suitable product for mixing with concrete to make it dense, and thereby rendering concrete more water-proof. The addition of small percentages of hydrated lime, when making concrete mixtures, is immediately effective in promoting plasticity throughout the mass, thereby rendering the concrete more homogeneous and keeping it so during transit, before placing. After placing concrete which contains hydrated lime, its subsequent spading in the forms is greatly facilitated, and the thorough covering of all steel reinforcing rods is more perfectly accomplished. In fact, concrete mixed with a small percentage of hydrated lime seems to almost automatically fall into place.

The proportion of plasticity and homogeneity, which small percentages of hydrated lime give to concrete, cannot be secured in any other way at so little added expense for the material used. On many large reinforced concrete buildings which are being constructed in the United States today, the concrete is mixed at one or two central mixing plants, which are generally located on the ground or in the basement of the building. After mixing, it is dumped into carriages and elevated, then distributed through galvanized iron pipes or chutes to the various parts of the building. It is a well known fact that Portland cement, when mixed with water, is not very plastic, some brands of cement being extremely non-plastic, and while the mixture for reinforced building construction is a rich one (generally 1-2-4), yet even so, it is sometimes very difficult to secure sufficient plasticity in the concrete to insure its being elevated, poured and distributed without considerable sticking and clogging of the pipes, attendant with more or less separation of the aggregate. An extremely interesting example of the effectiveness of hydrated lime in correcting the last named condition is well worth mentioning.

Hydrated Lime Used in Concrete Work of Two Large Dams

During the fall of 1912 and the winter of 1913 The Stone & Webster Engineering Corporation constructed a large concrete dam located on the White Salmon River, about seventy miles from Portland, Oregon. Our concern was retained by Stone & Webster and the Northwestern Electric Company, for whom the dam was built, to inspect the material used in the concrete work. A thorough investigation was made to determine the advisability of manufacturing the sand which was to be used in this work, and it was finally decided to erect a large crushing and sand manufacturing plant and secure both fine and coarse aggregate for the concrete in this manner. The sand was made by crushing a basaltic rock secured from the crusher located on the bank of the stream at an elevation of 600 feet above the river bed. The fine crushed rock was screened through a 1-4 inch mesh, and the fine and coarse crushed rock was stored in bins just above the mixing plant, from which point 80 per cent of the concrete was poured down a spout or chute 400 feet in length to the dam site below. From numerous test results it was decided to use 10 per cent of hydrated lime throughout the concrete, the mixture being 1-3-6. It is more difficult to secure

easy working concrete when using crushed rock as the coarse aggregate than when using gravel, this being due to the angularity of the crushed rock. In this case we not only had to contend with the crushed coarse aggregate, but sand sized material was also angular, in fact, to such an extent that the concrete mixture would not flow down the steel lined chutes without mechanical aid. By the addition of 10 per cent of hydrated lime, or approximately 40 pounds of hydrated lime per yard of 1-3-6 concrete, we literally transformed the physical appearance of the concrete as seen in the chutes. The concrete would leave the mixers, pass into the chutes and then onward without the slightest separation of the aggregate and would finally arrive at the dam in a perfectly homogeneous mass, where it would flatten out to a level with but little shoveling and spading in the form. The hydrated lime, together with proper mixing, had given the concrete sufficient plasticity to destroy the excess friction caused by the angular condition of the fine and coarse aggregate, and formed a smooth flowing, uninterrupted stream of concrete, to be deposited in its final resting place in the dam.

Without the use of hydrated lime in this work, it was actually demonstrated that it would have been impossible to secure satisfactory results without discarding the conveying of the concrete in chutes and instituting a far more expensive method of handling the concrete.

The writer has considerable data touching upon the use of hydrated lime in other important concrete structures, such as reinforced concrete conduits, floor slabs in building construction, concrete silos, and in lining tunnels with concrete, but it is quite satisfactory to have absolute record of its use in such important work as that noted above. Another instance where hydrated lime was used to great advantage and with considerable economy as compared to other water proofing compounds considered for this work, should be mentioned before passing on to his suggestions concerning its use in concrete when used for pavements.

In 1910 the Portland Railway, Light & Power Company constructed a large, hollow reinforced dam across the Clackamas River, some 30 miles from Portland. The construction of this type of dam was a new departure on the Pacific coast and the work was undertaken with great care. The dam was 90 feet high, over 600 feet long, and hydrated lime was used in all the concrete which was to be exposed to water pressure. All of this work was of reinforced concrete, with reinforcing steel closely spaced on centers. The aggregate was carefully graded sand and gravel, concrete mixture being 1-2-4 with 7 to 10 per cent of hydrated lime added to the weight of the cement per yard of concrete. The concrete as poured was plastic and homogeneous and went into place with extreme ease, while the finished concrete was uniform and dense and absolutely impervious to the flow of water.

These specific records of the use of hydrated lime in the concrete work of two of the largest hydro-electric developments on the Pacific coast during the last 4 years, serve as convincing engineering proof which can be readily verified, that hydrated lime is a product of great intrinsic value and one that can be used with utmost safety in concrete work for the purposes named above.

Important Essentials Involved When Placing Concrete to be Utilized as a Pavement

The utilization of concrete as a paving material during the last 5 or 6 years has developed into an extremely important business, and is destined to become one of the greatest if not the greatest consumer of Portland cement. Concrete pavements are found in practically all states in the Union, while the various counties of several states have practically standardized this pavement. Notable among these is the county of Wayne, which takes in the city of Detroit, Michigan. Since the inception of concrete road building in Wayne county, about 5 years ago, over 70 miles of concrete pavement have been laid, and the county long ago adopted concrete as its standard pavement. As this county has placed more concrete pavements, and of necessity had more actual experience in handling concrete pavements than any other section of the United States, it is interesting and in-

the filling in between these sections, as formed, by pieces of asphalted felt.

Placing and treatment of concrete pavements under the above specifications have produced results which are very satisfactory, and in carefully analyzing these specifications it would seem that every particle of engineering and common sense had been used. In practically every step in the process of laying the concrete it has been the intention to carry on the work so that future cracking may be eliminated, yet in spite of all these precautions more or less cracking has been known to develop and is generally attributed to settlement of the sub-base or the movement of the concrete, due to temperature changes.

Some Observations Concerning the Cause and Prevention of Cracking in Concrete Roads

From the writer's experience, gained in the testing of materials which go into concrete, as well as from experience acquired in the supervision of important



CLACKAMAS DAM.
90% Portland Cement; 10% Hydrated Lime.

structive to know what their specifications call for and how experience has taught them to do their work.

1. Great care is taken in preparation of the sub-base. Experience has shown that more cracking in concrete pavements has resulted from improper and careless treatment of the sub-base than from any other one cause for cracking; consequently the sub-base is rolled hard and made as uniform as possible; also density is desired so that water seepage from the concrete into the sub-base may be diminished as much as possible.

2. Careful specifications for the sand, gravel or crushed rock and cement are insisted upon and carried out to the letter. Careful proportioning and mixing of the concrete is also done.

3. During the last 4 years a gradual increase in the richness and thickness of the concrete has been specified and the present specifications call for a 1-2-3½ concrete mixture 7½ inches thick for a one-piece concrete pavement.

4. Care in protecting and covering all concrete after placing and keeping same covered for at least 10 days. This precaution is taken to prevent the loss of moisture by evaporation from the surface of the concrete.

5. The use of steel expansion joints cutting the entire depth of the concrete at each 25 foot section and

concrete work and examination of so-called "concrete road failures," he does not believe that the fundamental causes for cracking in concrete pavements are due to temperature changes in the concrete or settlement of the sub-base alone. There are other primary and extremely important reasons why these so-called temperature and settlement cracks develop at a later date, and until we take proper steps and exercise due care at the right time, we cannot greatly reduce this excess cracking.

No specifications for the laying of concrete pavement, to his knowledge, has taken into consideration the chemical peculiarities shown by Portland cement concrete in its preliminary setting and hardening periods. There has been no special provision for retaining to as large a degree as possible the actual mixing water first used in the concrete mixture. By careful treatment of the sub-base and protection of the finished surface of the concrete after pouring, it is the intent of the various specifications with which the writer is conversant, to retain in the concrete as much of this first mixing water as possible. While these precautions are a great help, they are not quite sufficient, as they rely to a great extent on treatment of surfaces to keep the water from leaving the concrete. The prevention of this leakage of water from concrete after the first few hours in which it is poured is an extremely important feature, and in this connection

it is well to bear in mind that the reaction between a solid, such as Portland cement, and a liquid, such as water, is a surface reaction, water only being able to react on the surface of the cement grain, and that, owing to the slowness of the reaction and the insufficient amount of water being present, **only a relatively small amount of the Portland cement is at first decomposed by water.** Consequently, if we can actually keep within the concrete mass what little excess mixing water we start with, or introduce into the concrete mass in the mixing, some substance that contains and will readily hold excess water which the cement may secure later, we will accomplish what has not been done before.

There is no more important period in placing a concrete road surface than in the first 24 hours after pouring the concrete, for it is during this period that minute spots of weakness generally develop, due to the loss of water by leakage and evaporation and use of water by the cement in setting, causing contraction during the first 24 hours. Upon the later permanent hardening of the concrete, we do not secure a slab of as great cohesive uniformity as would be expected on first consideration.

traction of concrete and any movement in its volume is due infinitely more to this alternate wet and dry condition than to any temperature change from hot to cold without presence of moisture.

That the cracking which is directly attributed to the change in the condition of the sub-base, either in settlement spots or in drying out in shrinking, is primarily due to the above cause, which is greatly helped by unevenness and variability of the concrete mixture.

That there are extremely few, if any, concrete pavements individual slabs of which can be considered entirely uniform.

Why the Use of Hydrated Lime Should Prove of Great Intrinsic Value in Concrete Pavements

The use of hydrated lime as a void filler in concrete mixtures, and for rendering concrete mixtures more water-tight, dates back several years. Numerous tests show that a replacement of from 10 to 15 per cent of cement by hydrated lime in rich mixtures does not decrease the compressive strength of the concrete after 3 or 4 months' time, and ultimately increases the strength and permanence of the concrete. It apparently makes but little difference as to its action as a void filler, whether the hydrate is manufactured from



SWEETWATER DAM.
90% Portland Cement; 10% Hydrated Lime. J. D. Schuyler,
Engineer; A. S. Bent, Contractor.

The general conditions under which concrete pavements are placed are severe, as the majority of work is usually done in the dry spring and summer months when temperatures are high, causing excessive evaporation. The concrete is generally poured on an earth or clay sub-base in a thin slab varying between 4 and 7 inches in thickness. This condition alone makes it almost impossible to secure uniformity throughout the concrete mass, so that after hardening the concrete road slab is subject to far greater variation, due to the segregation of the coarse aggregate from the mortar, than is found in other forms of concrete work. This, of necessity, causes unevenness throughout the concrete, and the excessive cracking and raveling so often seen in poorly laid concrete roads is directly due to this fact.

It is the writer's opinion that the primary cause of cracking in concrete pavements is due to the loss or leakage of varying portions of the mixing water by seepage through the sub-base, as well as in evaporation from the surface of the concrete, which leaves the road slab in such a condition that at later times it will alternately absorb and give up water, depending on the season of the year, and that expansion and con-

a dolomitic or high magnesium lime or a high calcium lime—it being necessary only to have a product which contains no free lime or unslacked particles. The proper hydration or dry slacking of lime reduces it to a finer degree of sub-division than can be accomplished by any mechanical means.

The amount of water required to convert the dry hydrated lime into a plastic paste varies from 50 to 70 per cent of the weight of the lime; while to obtain a mortar of similar consistency with Portland cement, an addition of 25 to 30 per cent of water is required.

Unlike Portland cement, however, the addition of water to hydrated lime does not create any chemical reactions. There is simply a lime paste formed which holds its excess water for a long time. Upon the addition of small quantities of hydrated lime, amounting to 10 or 15 per cent to the weight of cement used in concrete mixtures and the ordinary mixing of such mixtures the hydrate, which has absorbed a large amount of water, corresponding to its weight, is thoroughly disseminated throughout the concrete mass, and due to its fine plastic condition, it is forced immediately into places in the concrete which the cement cannot reach.

Concrete, so mixed, on leaving the mixer, flows more readily into place and the coarse aggregate has much less tendency towards segregation in the concrete mass. In other words, the extreme finely divided condition of the moistened hydrated lime paste has increased to a marked degree, the covering or spreading quality of the cement, and reduced, to a similar marked degree, the friction between particles of fine coarse aggregate.

This answers the question of "why hydrated lime benefits concrete"—the action is purely a mechanical one, and can be compared to the oiling or greasing of a shaft or bearing. The property which hydrated lime has of absorbing and retaining large percentages of water offers a ready solution to the problem of finding a means for keeping and holding moisture in freshly poured concrete until the slower acting cement hardening process can utilize it.

From a study of the foregoing data it is perfectly obvious that small percentages of hydrated lime, when added to concrete mixtures in road work, will accomplish the following things:

1. Rendering of the concrete highly plastic and homogeneous, thus producing density and uniformity in the finished concrete. This condition adds much to the life and efficiency of the road, because of the uniform resistance to wear and other stresses.
2. Keeping a certain amount of excess moisture in the concrete while setting.
3. Rendering the concrete mass more nearly watertight and thereby preventing the alternate wetting and drying out of the finished concrete.
4. In large pieces of work, the above properties given to concrete by hydrated lime would materially reduce the labor in spreading and bringing the concrete to a uniform surface, which is of great importance in paving work.

VOLUME CHANGES IN PORTLAND CEMENT AND CONCRETE

By A. H. White

Portland cement structures retain their colloidal property of expanding when wetted and contracting when dried, even after 20 years' exposure to the weather, and after baking to 600 degrees Fahrenheit. A bar of neat cement may be made to expand or contract progressively, according to the choice of moisture conditions. It may be made by successive bakings to contract as much as 4.6 per cent. Cement bars containing sand do not contract readily on account of the interlocking of the aggregates. When such bars are dried they become more porous, and, therefore, on immersion more water can enter, so that new particles of cement clinker will be hydrated, with a still further resultant elongation of the bar. Bars of 1:3 sand mortar have by successive bakings and boilings been made to elongate 0.75 per cent. Bars cut from sidewalks taken up after 20 years' service have been made to elongate 0.175 per cent by successive immersions in water at room temperature. This elongation is as much as would be calculated for a rise in temperature of 300 degrees Fahrenheit.

It must be considered a grave source of danger to concrete highways in wet locations. Dense concrete, even when wet, does not contain any liquid water and does not suffer any expansion on freezing. Such concrete when measured while frozen will be found to have contracted at the same rate as cast iron. Porous concrete containing liquid water expands on freezing and does not return to its original length on thawing because of the wedgings of the aggregates. Repeated freezings will thus cause progressive disintegration.

CONCRETE SILOS

Thirty-two concrete silos were built in Kane County, Ill., during the 1913 season by W. H. Warford of Geneva, Ill., and he expects to double this in 1914. One of these silos was for Wilson Bros. of Sugar Grove, Ill. They write:

"Our silo cost \$1,000.00 in round numbers. As a rule a 12-foot silo costs \$12.00 per foot; a 14-foot \$14.00; a 16-foot \$16.00; an 18-foot \$18.00. The capacity of our 64x16 foot filled and refilled is 400 tons. It will feed eighty head of cattle for six months. Silage is the basis of our feed and not because it is cheap but because it is enjoyed by the cows, giving them green feed in the winter. The time is right on our heels when we will be compelled to put up one or two more so that we can keep double the number of cows on the same number of acres. It requires 36 acres to fill this 64-foot silo.

"My neighbors told me that I was crazy—that I would not be able to get the silage into the silo; but after seeing how easily we filled it I wished we had made it 75 or even 100 feet. It is all on one foundation and the higher up it goes the more you can get in because it packs so solidly. Climbing up the silo is no factor or an elevator would be a small expense.

"Our farm consists of 200 acres valued at \$300.00 per acre. We rotate our crops and keep our land in a high state of cultivation. We raised 75 acres of corn. This year our corn husked 80 bushels per acre. Our present herd consists of eighty head, mostly Holsteins, with a good many pure bred."

We wrote to the contractor, W. H. Warford, to ask for a few facts about the silo in addition to those in Mr. Wilson's letter. He answered as follows.

"I can add only that $\frac{1}{4}$ -inch, $\frac{3}{8}$ -inch, $\frac{1}{2}$ -inch and $\frac{5}{8}$ -inch square twisted steel bars were used for reinforcing, the heavier bars at the bottom where the bursting pressure is greatest. We used washed gravel, Torpedo sand and Universal Portland cement. The doors are elliptical in shape, spaced 19 inches apart. This gives exceptional strength to the reinforcing as it passes completely around the circle without a gap at the doorway.

"I am now building another unique combined silo and tank. The silo will be 60 feet 9 inches high with a 19-foot tank on the top which will hold 18,500 gallons. I use steel forms made by Polk-Genung-Polk Co., Fort Branch, Ind.

(Signed) W. H. WARFORD."

Mr. Warford builds silos but this is not the extent of his work. There are many small structures about the farm that can well be entrusted to a reliable contractor. When there is a local man who can handle this work for the farm it will doubtless save trouble and sometimes expense on account of the labor-saving equipment which the contractor owns.

CONCRETE PIPE

Adams county, Iowa, has over 900 bridges, including culverts. This county is now manufacturing for culverts a concrete pipe 5 feet in length and 15 inches in diameter, reinforced with strong wire netting. For this size pipe they formerly paid \$1.15 per foot, whereas now it costs the county only 40 cents, a net saving of 75 cents.

The institution of these pipes is largely the suggestion of E. C. Simmons, county engineer, Corning, Iowa. Mr. Simmons was formerly state engineer of Nebraska. He, with the supervisors of Adams county, invite other county boards to inspect their plant and will be glad to give any information leading to better highways.

STUCCO FOR EXTERIORS

If one can believe his eyes, the old-fashioned rough-cast house, plastered outside and in with mortar made from ordinary slaked lime, gives proof, in many instances, of the wonderful enduring power of that material when properly used. There is no doubt, however, that cement stucco, other things being equal, is the most durable of all materials for exterior plastering.

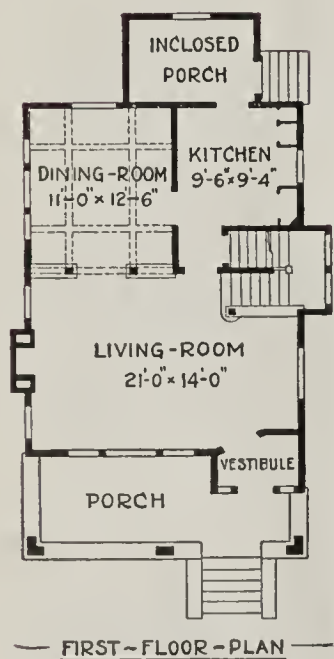
The trouble altogether too frequently observed in its use—especially the development of cracks—is due

will dry so quickly that cracks are certain to result. Again, if too much cement is used, cracks are liable to appear. Dryness in any form results in cracks, which in some cases are so fine as not to be discernible except by close inspection. These cracks will in time admit moisture, rain carrying sulphur and ammonia, which will in time break down the protective covering; and the stucco will fall away either by disintegration or by peeling off.

One essential, therefore, to good work is that the plaster must not lose its dampness too rapidly, and

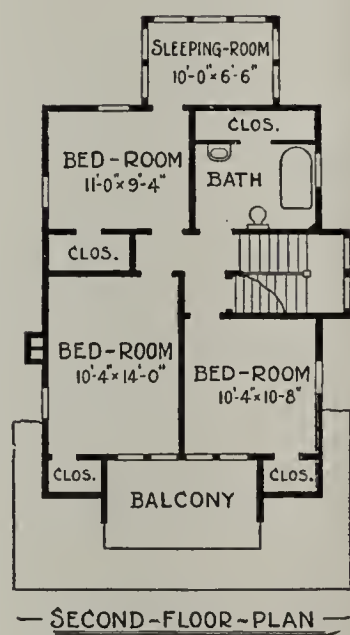


Residence of Mr. Jas. Murray, Kalamazoo, Mich.
Architect, R. M. Gallup, Kalamazoo, Mich.
Approximate Cost, \$2,400.00.



This illustration shows the possibilities of stucco construction for the small house. One of the many advantages of this method of building is that it is suitable for any type or cost of residence. The value of stucco on metal lath for exterior walls is being recognized by architects in every locality, and every city contains many excellent samples of stucco houses.

"Kno-Burn" Metal lath was used on the house shown above.



in large part, says the "Builder," to the fact that cement sets quickly—much more quickly than lime. If, however, just sufficient of each ingredient is used (with accent on the word "just"), and neither too little nor yet too much water is added, a stucco can be produced that is far superior to any other in weathering powers. If an excess of water is employed, the plaster will not cling properly to the wall; yet, on the other hand, if too little be used, the cement plaster

this can be done by keeping the surface wetted or by way of damp cloths hung in front of the wall. It is also necessary to prevent the water in the cement being absorbed by the brickwork on which it rests, and this can be done by previously well wetting the brickwork.

To make a good weather resistant, the stucco must be dense. This can be obtained by mixing the concrete stiff, and yet containing the necessary water to

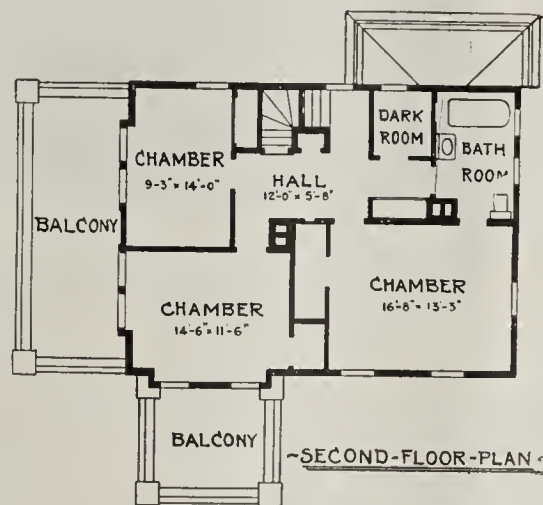
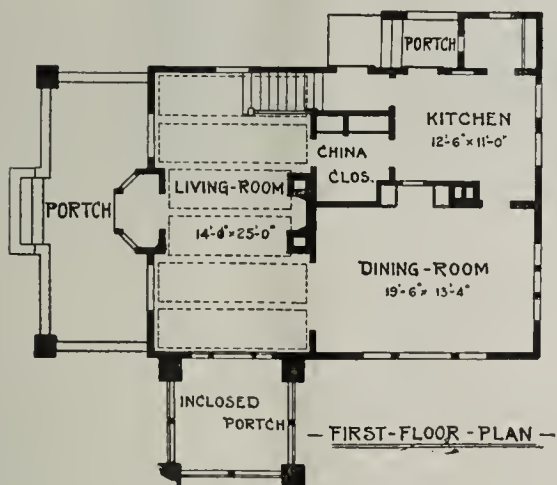
prevent rapid drying, which will allow the plaster to work rapidly. A very thorough mixing will accomplish this. Troweling the surface should not be done too much; for, although by this means density is secured, the result will only be the trouble of cracks when dry, which is to be avoided. Troweling brings the water to the surface, and the work is liable to dry too rapidly.

Where furring strips are used for the purpose of affixing metal mesh, precautions must be taken to

Where lime is used with cement, the limit should be 10 pounds of hydrated lime to one bag of cement, and this should be used only for the second coat. The first and last coats should not contain more than five pounds per bag of cement; in fact, it were better to use none at all in the finishing coat. Only hydrated lime should be used, and no plasterer's putty. Hydrated lime is lime scientifically prepared, being properly cleansed and screened, and is free from all impurities. A good substitute for sand is asbestos rock



Residence of A. W. Hamaun, Davenport, Iowa. Architect, A. H. Ebeling, Davenport. Approximate Cost, \$4,950, Exclusive of Heating and Plumbing.



prevent danger from them. This arises from the fact that they are liable to split under the influence of wetting and drying, at those places where staples have been driven in to fix the metal mesh, and, the mesh becoming loose, the stucco and mesh fall down. By attaching the mesh to the wood strips by galvanized iron wire tied around both, this danger is avoided.

A good lap should be given to the mesh joints, or at these places cracks in the stucco will appear. There is danger in using metal lath with some patent plasters, as some of these contain acid, which attacks the metal. It is desirable, therefore, where such are used, to give the mesh a coat of lime wash or some similar protective coating.

and fiber. The fiber performs the binding function of ox-hair in plastering, the stucco being less liable to crack. The use of asbestos fiber along with cement and sand can be recommended. Other aggregates, such as crushed marble, finely crushed granite, and similar rocks, are used, where some special finish is desired.

To obtain a rough-cast finish, mix 1 part hydrated lime with 2 of Portland cement, mixed dry, and add water until a thick paste is obtained. Put this into a pail, and, keeping it well mixed, take out by means of a paddle or trowel, which, dashed against a stick held in the other hand, splashes the mixture onto the wall, giving the rough-cast finish.

CONCRETE BLOCKS

By James C. Keller

It may be broadly stated that in the city of Cleveland at the beginning of the current year the outlook for concrete block as a building material was rather gloomy; in fact, the concrete business in some of its phases seemed in the throes of final dissolution.

Block were in disrepute and the city building commissioner was on the point of condemning them and forbidding their use in the erection of buildings.

This condition was due to two causes. First, the generally poor quality of the product; second, the strong, active opposition of the clay brick interests.

Building block and the commoner forms of concrete building units were poor because those engaged in their manufacture had no knowledge of the business in which they were engaged—the making of concrete building units was a “job” instead of an industry.

One of the contributing factors in this condition was the block machine salesman, whose business is to sell machines and whose income depends upon such sales as he can make. This led to the establishment of numerous back-yard plants, the mixing of common dirt with cement and the making of so-called block

facturing concrete building material, ascertaining what materials are used and in what proportions and finally a series of tests to determine whether or not the products measure up to the established standard in tensile and compression strength as well as in absorption. The salary of the special inspector of the Cleveland department of buildings, who devotes himself to the field of concrete block and stone manufacture and construction, is paid by the block manufacturers. The members of the organization raised their dues from \$2 a year to \$2 a week, in order to take the progressive steps necessary to get concrete building products on a proper footing.

As a result of this action contractors know just what they are getting and where they can get absolutely reliable material, and the “ultimate consumer,” the home owner and the building user are fully protected.

It is our firm belief that concrete as a recognized factor in the construction of modern buildings, whether it be reinforced or unit construction, can never hope to attain its full development or recognition until the commonest unit is fully established.

Acting upon this theory, makers of building block



Park View Apartments, Skinker and Waterman Avenues, St. Louis, Mo.
Concrete Blocks Faced with Medusa White Portland Cement.
Yourtee & Hubbell, General Contractors and Manufacturers Cast Stone.

which under the most favorable conditions might hold together until they reached the job on which they were to be laid.

Proper aggregates, proportions, the filling of voids, the creation of bonds, the necessity for proper tamping, the principle of curing, were as foreign to a great many of the so-called block manufacturers as is algebra to a mule.

Today all this is changed. True, there are still a few left whose product does not come up to the standard, but this condition is being rapidly overcome either by the improvement of the product or the elimination of the maker.

What has brought about this change from bad to good?

The organization of those engaged in the manufacture of concrete block, chimney flues, etc. The establishment by code of certain minimum requirements, the appointment by the city of an inspector whose duty it is to supervise fully all plants manu-

in the city of Cleveland set about to place their product upon a high plane. This being accomplished, we shall now enter upon the manufacture of concrete tile and brick. We shall produce units of various kinds which will recommend themselves as purely concrete products and which will lend themselves to the erection of homes, factories, warehouses and office buildings, because they are the best material that can be secured, not because they are the cheapest.

The opposition of the clay brick interests is something we now welcome. Their misrepresentations are being disproved, their statement to builders that concrete is unreliable, especially in case of fire, is receiving some severe shocks, especially in such instances as the Baltimore fire and more recently in the Salem, Massachusetts, fire.

What we have done so far is only a beginning; before we get through we shall have absolutely placed concrete in all its forms upon the map as the best, the most reliable and the most modern of all building materials.

PROPORTIONING AGGREGATES FOR CONCRETE

By Albert Moyer*

To arrive at a scientific and at the same time practical method by which to properly proportion the aggregates for Portland-cement concrete we must examine the larger available aggregates and so graduate them in size of particles that the smallest percentage of voids results and, consequently, that less mortar is required to obtain maximum density and therefore maximum strength. The principal requisite is the making of a sufficiently dense and rich mortar to bind together pebbles or crushed stone by entirely filling the voids. The study of this subject must be more particularly directed towards the proportioning of

Proportioning the Mortar

There are various methods of determining the amount of Portland-cement paste required to fill the voids in the sand, among which are (1) the determination of the percentage of voids by the specific-gravity method, and (2) by the water test (that is, the volume of water required to fill the voids); (3) experiments to determine directly the required amount of paste by measuring the volumes of mortars of various proportions, and (4) making up the mortars into briquettes and breaking them in 7 and 28-day periods.

[The descriptions of the specific gravity and water methods, because so well known, are omitted here. The third method, while also previously described, is treated briefly because the discussions which follow are based, in part, thereon.]



New Reinforced Concrete Factory of the Pacific Sugar Company, Corcoran, California. Designed and Constructed by Mr. Walter J. Wayte, Consulting Engineer, New York.

sand, Portland cement and water. The grains of sand must be bound together and the voids between the grains entirely filled with Portland-cement paste. It is the proportioning of this paste that we must study in order to determine the amount of cement and water which shall be added to any particular, available sand.

Weight and Volume of Cement

In figuring proportions, we must determine the amount of Portland-cement paste required to fill the voids in the sand. Experiments made by S. Warren Hartwell would indicate that 110 lb. of Portland cement mixed with 25 per cent of water are required to produce 1 cu. ft. of paste. The cement must be measured by weight and not by volume, for it has been found that 110 lb. of Portland cement will occupy 1.12 cu. ft. if measured loosely and dry, while if packed tightly it will occupy only 0.96 cu. ft. If 94 lb. of Portland cement is figured as 1 cu. ft., there is not enough cement in the concrete.

Therefore, in using a sand in which there is found to be 38 per cent of voids, the proportion would be 110 lb. of cement to $2\frac{1}{2}$ cu. ft. of sand, or 1 cu. ft. of cement paste to $2\frac{1}{2}$ cu. ft. of sand. If it is necessary to use the bag (94 lb.) as the unit for measuring the cement, the proportions should be computed as follows:

$$94:110::38:x$$

from which $x=44$ per cent, which calls for a proportion of $1:2\frac{1}{4}$. Therefore, using the bag as a unit, the proportions will be 1 bag of cement (94 lb.) to $2\frac{1}{4}$ cu. ft. of sand. It is certainly impracticable to change the size and weight of the package, and it is convenient to use the package as a unit for measurement. Therefore the actual percentage of voids in the sand should first be calculated and then arbitrarily increased by means of the above method.

Experiments with Mortars of Various Proportions

Pour 200 cc. of dry sand into a glass very slowly, tapping the bottom and sides so that it will settle in as dense a mass as possible. Then pour out the sand and determine its weight to a hundredth of an ounce. Measure out several more 200-cc. samples of sand, weighing each time as a check on the quantity of sand in each sample. Then determine the volumes of cement paste required to be mixed with the 200-cc. samples of sand to give the various proportions under investigation, and measure out the necessary amount of

Table 1—Weight of Cement Required for a Given Volume of Cement Paste
1 Cu. Ft. of Paste Contains 110 Lb. of Cement;
Therefore 100 cc. of Paste Contain 6.22 Oz.
of Cement

Proportions by volume	Volume of cement paste, cc.	Volume of sand, cc.	Weight of cement required, oz.
1:1½	133	200	8.27
1:1¾	115	200	7.16
1:2	100	200	6.22
1:2¼	89	200	5.53
1:2½	80	200	4.97
1:2¾	73	200	4.55
1:3	66	200	4.11
1:3¼	62	200	3.86
1:3½	57	200	3.55

cement by weight, assuming the weight of cement to be 110 lb. per cubic foot. These data, for various proportions, are given in Table 1. The following proportions, by volume, of cement paste to sand are suggested for investigation: $1:1\frac{1}{2}$, $1:2$, $1:2\frac{1}{4}$, $1:2\frac{1}{2}$, $1:2\frac{3}{4}$, and $1:3$.

Mix each sample of cement with 25 per cent of water, then with a 200-cc. sample of sand, and tamp the resulting mortar into the graduated glass, a little at

*Paper read at the annual meeting of the American Society for Testing Materials.

a time, with a flat-end stick. Note the volume occupied by the tamped mortar.

The object of this test is to ascertain what proportion with a given amount of sand will produce maximum density with a minimum amount of cement. Since the same amount of sand is used in each sample, it is evident that with too much cement the volume of the mortar will be increased. Therefore, in progression from the leanest to the richest mixture, that sample which first starts to increase the volume of the mortar is the one which contains the correct proportions for that particular sand.

Tests of Briquettes.

The reason for using 200 cc. of sand in the previous experiment is to obtain sufficient mortar to make three briquettes. By inverting the glass and jarring the top against a rigid surface, the mortar will be released, usually in a solid mass. Make up each sample of mortar into briquettes, store in a moist closet and break in 7 days.

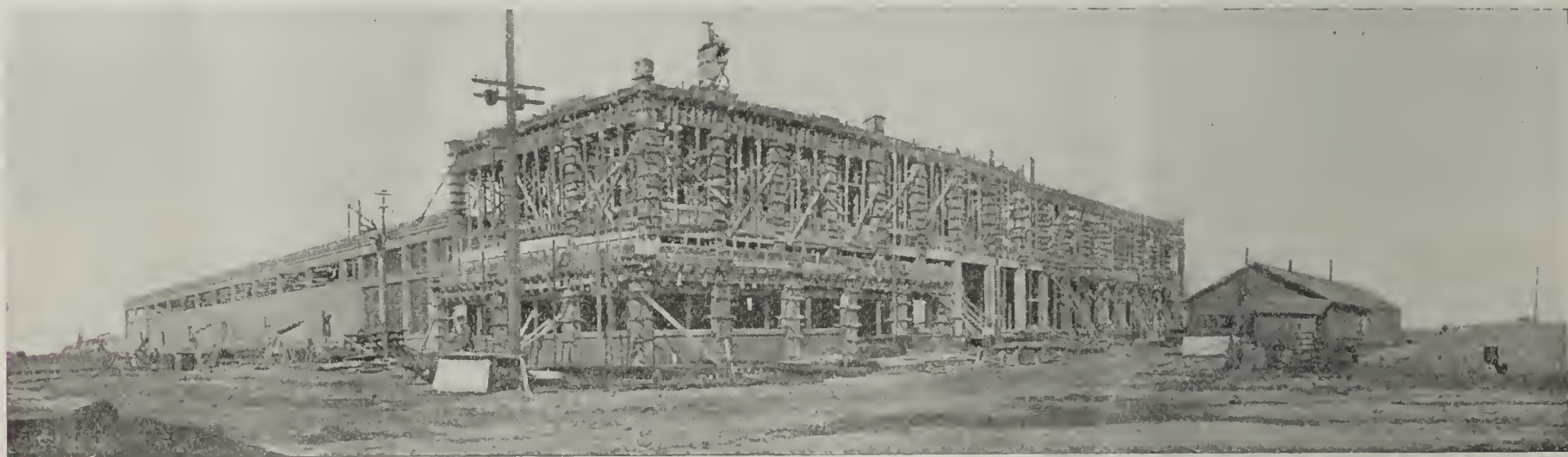
This strength test is a check upon the accuracy of the above tests for the proportions of cement to sand which will produce maximum density, maximum

and stronger concrete than the best sand. Poor stone screenings, however, such as soft limestone, marble, sandstone, etc., do not make as good a mortar for concrete as does good sand.

Proportioning the Larger Aggregates

Let us now consider the proportioning of the larger aggregates, keeping in mind that the voids in these aggregates are to be filled with mortar as previously described. It is sometimes best to use two sizes of stone, a large size and a smaller size; the smaller size, however, should all be retained on a $\frac{1}{4}$ -in. mesh sieve.

In order to ascertain the best mixture of the smaller and larger sizes of stone or pebbles, make a receptacle which will hold a little over 4 cu. ft. (or use a 15-in. sewer pipe). Measure 3 cu. ft. of the larger stone and 1 cu. ft. of the smaller stone. Mix well together, place in the receptacle and note the space which it occupies. Empty the receptacle, measure 2 cu. ft. of the larger stone and 2 cu. feet. of the smaller stone, mix as before and mark the space occupied. Vary the proportions in this manner, always adhering to a total of 4 cu. ft. The mixture which occupies the least space in the receptacle will make the densest concrete.



Reinforced Concrete Factory of the Pacific Sugar Company in Course of Construction.

strength and maximum bonding. The results of the four tests should agree. If they do not, the tests should be made again. If there is still a considerable variation, wash the sand and retest.

Comparison With Ottawa Sand and Value of Screenings

It has been proposed in various specifications to test sand by comparison of its strength with that of standard Ottawa sand. This might cause the rejection of a good sand, for if the comparison is made with 1:3 mortar for each sand, the sand under investigation may not show proper strength in those proportions. The percentage of voids in each sand should be calculated, the mortars made up in the proportions necessary to fill the voids in each sand, and the briquettes tested for tensile or crushing strength. Each mortar will then be of maximum density for its respective sand, but different proportions are of necessity used. The comparison, therefore, should be made not on the basis of mortars of the same proportions but on mortars of maximum density.

If screenings or quarry tailings passing through a $\frac{1}{4}$ -in. mesh sieve are used in place of sand, their voids are determined in the same manner as those of sand, previously described. The tailings, however, should be of such size that not more than 20 per cent passes through a No. 50 sieve and not more than 10 per cent through a No. 100 sieve.

Trap-rock screenings make a very excellent substitute for sand; in fact, they will make a far tougher

The percentage of voids should then be determined either by test or by weighing the stone or gravel and referring to a table giving the percentage of voids for different weights of various kinds of aggregate.

The percentage of voids being known, the parts of stone required for various proportions of mortar to fill the voids can now be found.

Conclusion.

It may reasonably be stated, therefore, that aggregates proportioned as above described produce a concrete which is denser and stronger than aggregates not so proportioned. Thus, with a given aggregate and an arbitrary specification of 1:2:4, a weaker concrete might be obtained than if the aggregates were properly proportioned in accordance with the principles above described and the proper proportions proved to be, for example, 1:2 $\frac{1}{2}$:4 $\frac{3}{4}$.

If these principles are kept constantly in view, no engineer, without previous knowledge of the aggregates that are going to be used, can conscientiously write a specification and arbitrarily specify 1:2:4, 1:3:6, or whatever his favorite formula may be.

UPPER HUDSON STONE CO.

The Upper Hudson Stone Co., New York, will install electric drive equipment in its plant at Marlboro, N. Y., consisting of five motors ranging from 50 to 300 hp., three 200 kv-a. transformers and switchboard apparatus.

United States Cement Mill

There are two interesting developments at the United States Portland cement plant at Concrete, Colorado. One of these is in the quarry and one in the mill.

The old method of quarrying the shale was to put down a small churn drill hole about 15 feet back from the face. This hole would be 15 to 20 feet deep, and was drilled by hand. When finished it would be "sprung" by putting a few sticks of dynamite in the bottom and exploding them.

The effect of the dynamite is to make a large pocket at the bottom of the hole. This pocket is then filled with black powder and the hole shot. The relatively slow explosion of black powder shakes up a very large amount of shale, sufficiently to make it available for loading with a steam shovel.

An improvement on this system has been introduced by drilling the holes with a steam-actuated well drill. This machine drills a hole 4 inches to 6 inches in diameter, which is large enough to load without springing.

This is a great advantage. Not only is it a saving in time and powder, but sometimes the springing



The United States Portland Cement Company's Plant at Concrete, Colo. In the Quarry They Operate Armstrong Special Blast Hole Drills, Marion Steam Shovels, and Use Du Pont Powder.

charge leaves a live coal of some sort in the hole, which ignites the black powder when it is put in, causing a premature explosion. Furthermore, the churn drill is not limited to 20 feet of depth, but can drill 60 feet if need be. The Armstrong special blast hole drill was manufactured by the Armstrong Manufacturing Company, Waterloo, Iowa. As the quarry face works back into the hill, this will be a great advantage. Du Pont Powder Company furnish all the dynamite used by this company and the crushed rock is loaded into dump cars by Marion Steam Shovels, manufactured by Marion Steam Shovel Company, Marion, Ohio.

The other interesting development is in the mill itself. Although the United States Portland has a deposit which is probably nearer a perfect cement mixture than any other deposit now being worked, still it is necessary to mix a very little lime with the shale to get perfect proportions.

This is done in the following ingenious manner:

The shale and lime are ground to 12 mesh separately and stored in separate bins. Each bin discharges into a screw conveyor, which acts as a feed. Two screw conveyors each discharge into a third, which acts as a mixing conveyor.

At the discharge end of the third conveyor is a sampling device, which accumulates a sample every 10 minutes.

Each of the first two conveyors is driven by a variable speed motor properly geared down. The variability in speed is controlled by rheostats, one to each motor. The particularly ingenious part of the device

is that instead of placing the rheostat near the motors, they are placed 50 yards away in the laboratory, so that the regulating dial is flush with the top of the chemist's bench.

The chemist not only determines what proportions shall be used, but he actually adjusts the feed with his own hand to give those proportions.

The feeding and proportioning devices are covered with iron covers and locked, so that no one can do anything to this machinery but the chemist himself. A sample goes to the chemist every 10 minutes, day and night, so that uniformity of grade is absolutely assured. [Denver News.]

SHOOTING BIG ROCKS AT PEMBERTON QUARRY WITH DU PONT POWDER

The American Lime & Stone Company, at their quarries at Pemberton, Pa., near Union Furnace, have a Cyclone well drill, with which they drilled seven holes, each five and five-eighths inches in diameter and 163 feet deep, extending along the face of the quarry for 102 feet, and having a perpendicular drill face of 163 feet.

Eight thousand five hundred and fifty pounds of Du Pont dynamite, running from 40 to 60 per cent in strength, was used. The amount of stone thrown out was approximately 32,477 tons, equivalent to 650 carloads.

Nothing was broken or injured in the explosion, excepting a small amount of track. The face of the quarry is about 300 feet from the railroad track.

E. H. Shainline, of Norristown, had charge of the blasting. It was probably the most successful deep hole drilling and shooting that has been done in the limestone quarries of Pennsylvania.

GRAVEL PLANT

The Southern Sand and Gravel Company, of Richmond Va., has a very complete and up-to-date plant at Fredericksburg, Vt., capable of turning out forty cars of washed gravel and sand per day. They operate a Lidgerwood-Crawford drag line excavator for digging and loading their material in dump cars; they also operate two centrifugal pumps made by the Morris Machine Works of Baldwinsville, N. Y., which give excellent service.

STATEMENT OF OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF AUGUST 24, 1912.

Statement of the ownership, management, circulation, etc., required by the act of August 24, 1912, of Cement & Engineering News, published monthly at Chicago, for October, 1914:

Editor, William Seafert, 64 W. Randolph St., Chicago.

Business Manager, John F. Waldron, 64 W. Randolph St., Chicago.

Publisher, William Seafert, 64 W. Randolph St., Chicago.

Owners: (If a corporation, give its name and the names and addresses of stockholders holding 1 per cent or more of total amount of stock. If not a corporation, give names and addresses of individual owners.) William Seafert is sole owner.

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WILLIAM SEAFERT.

Sworn to and subscribed before me this 18th day of September, 1914.

(Seal) GORDON BERG, Notary Public.

(My commission expires Aug. 16, 1916.)

Note.—This statement must be made in duplicate and both copies delivered by the publisher to the postmaster, who shall send one copy to the Third Assistant Postmaster General (Division of Classification), Washington, D. C., and retain the other in the files of the post office. The publisher must publish a copy of this statement in the second issue printed next after its filing.

WILL SHOOT LARGE BLAST

Up to the present date in the quarrying of granite there has been no blast on record to equal the one to be set off by the Wisconsin Granite Company, says the Argus-Leader of Sioux Falls, South Dakota. An idea of the great amount of solid granite to be torn from the south face of quarry, can be had by the dimensions of the size of holes and area covered which the company has furnished to the Argus-Leader. The diameter of the holes are $6\frac{1}{2}$ inches, and depth averaging 31 feet, seven holes in all, covering in length a distance of 200 feet and 25 feet back from the edge of the quarry. The approximate amount of explosives will be in the neighborhood of 2,600 pounds of the highest explosives. The amount of rock the blast will loosen will be about 8,000 cubic yards, when this amount has been crushed and loaded into cars it would mean a train of 350 cars or two and one-half miles in length.

The new drilling method was installed at the Sioux Falls plant of this company by Jos. M. Druecker, assistant to the general manager, Mr. John J. Sloan. Under the direction of General Manager Sloan, Mr. Druecker expects to install similar equipment at the other plants of the company. The Wisconsin Granite Company operates eight plants in Wisconsin and two in Chicago, giving them the largest capacity of crushed granite in the United States, the company being also large producers of paving blocks, curbing, monumental and rough stock. The crushers used in their quarry at Sioux Falls are a No. 3 and a No. 6 McCully, furnished by Power and Mining Machinery Company, Cudahy, Wisconsin.

There is nothing in the progressive features of quarrying that is practical that the general manager and secretary of the company, Mr. J. J. Sloan, does not adopt, and it is through his untiring efforts and ability that granite business in the paving line has become so popular throughout the country, the fact that the superior qualities of crushed granite, over other materials for paving, is demonstrated by increasing growth of the product. Owing to the immense capacity of this corporation, they will be able to supply the trade with any size rock ranging from sand to 3-inch in diameter perfectly screened and at the lowest possible price.

The loading and firing in connection with the discharge of this large shot will be under Mr. Druecker's personal supervision, this being the twentieth shot of the large hole type during his career, the first being in limestone quarries, one shot at Racine, Wisconsin, which was set off about eight years ago. Mr. Druecker states that they used 11 tons and 800 pounds of 40 per cent nitro and threw out 72,000 yards of limestone. Having made many others in granite quarries, but not quite as large as the present one, he feels perfectly safe and without doubt in assuring the residents against damage, as similar blasts in other communities have never caused damage. As to the results, we will leave it to Mr. Druecker, the man behind the gun.

Mr. Dan Ross, Jr., the superintendent of the local crushing plant of the Wisconsin Granite Company, says an invitation has been extended to Mayor Burnside to touch the button to set off the blast that will go down in history of granite quarrying.

Mr. Hower, city engineer, will christen the blast with a bottle of champagne. Other city officials, contractors and the editors of the Argus-Leader and Sioux Falls Press have been invited to be present.

NEW LIME PLANT

Ground has been broken for the new hydrated lime plant and pulverized limestone plant of the Steacy & Wilton Company, Wrightsville, Pennsylvania. Rich-

ard K. Meade, chemical, mechanical and industrial engineer, 202 North Calvert street, Baltimore, Maryland, is the consulting engineer, and the Steacy-Schmidt Manufacturing Company, York, Pennsylvania, are the contracting engineers. The hydrating plant will be one of the finest ever built and will have a capacity of 75 tons per day. The building will be of steel and the machinery will be driven by individual motors. The plant like that of the Louisville Cement Company, Milltown, Indiana, also designed by Mr. Meade, is unique in that it contains only one elevator and has been designed both for efficiency of operation and quality of product. The latter will be very high as the lime manufactured by the Steacy & Wilton Company now enjoys the reputation of being one of the purest high calcium limes found in the country.

ECONOMY OF PERMANENT BRIDGES

Extract from an address before the Kansas Engineering Society.

By Daniel B. Luten

The day of permanent bridges has arrived. It can easily be shown that it is no longer economical to build temporary bridges of wood or steel except for unusual locations and conditions. Assume for example, that a 50-foot bridge of a temporary character costs \$1,000 and that the amount be borrowed at 5 per cent interest. Assume also that the life of the bridge will be 25 years—the average life of a steel highway bridge—and that the bridge will require reflooring at intervals of five years, and repairing at intervals of eight years.

Then for the 25 years:

Interest charge, 25 years @ \$ 50.00..	\$1250.00
Reflooring four times @ 100.00..	400.00
Repainting two times @ 50.00..	100.00

Maintenance for 25 years.....\$1750.00

This is at the rate of \$70 per year. The original loan of \$1,000 still remains unpaid, but an additional loan of \$1,000 must be made to replace the bridge. Hence, for the next 25 years the maintenance will be increased by the interest on the second note, making \$120 a year. For the third 25 years the cost will reach \$170 a year with \$3,000 borrowed, and at the end of a century the maintenance will be \$270 a year with \$5,000 owing on notes.

If, instead, a permanent bridge has been built, all of the maintenance for the first 25 years might have been expended for interest, making a loan of \$1,400 possible at the same cost per year and this would never need to be increased. That is to say, it would be economy, even for the first 25 years, to pay 40 per cent more for a permanent bridge. And, if a sinking fund were established to meet the notes at the end of each 25 years, about \$26 per year additional would be required, making the maintenance charge \$96 per year which is the interest charge of \$1,920. So that under the above conditions a permanent bridge would be worth 92 per cent more than the temporary bridge above described.

POLK SILO SYSTEM

The Polk-Genung-Polk Company at Fort Branch, Indiana, is just completing a new factory for the manufacture of Polk system steel forms for circular concrete work, and also for the manufacture of the new Polk power concrete mixers which this company is putting out. The new building is fireproof throughout, being principally of monolithic concrete, the office portion carrying a veneer of vitrified brick. Provision has been made for increasing the capacity of the factory 200 per cent as the increased business of the company shall warrant.

A GRAVEL WASHING PLANT

The Oreilly & Burpee Co., of Portland, Oregon, generally known locally as the Hawthorne Dock Company, have in operation a rather interesting gravel washing and screening plant. This company furnishes sand and gravel for building purposes to the contractors and builders of Portland. The accompanying photographs show two views of one of their plants which is located on the Willamett river.

The gravel delivered to the plant is brought up the

screen plate for the first half of the length of the screen is provided with one-inch square perforations and the perforations in the remainder are 2-inch squares. The rejections from the screen along with the sand and water from the jacket are discharged to the side of the buckets and used to fill in around the foundation pile.

The main point of interest in this plant is the fact that one conveyor not only serves all of the different bunkers, but also serves the washing plant when that is in operation.



Fig. 1. Loading the Conveyor by Means of a Grab Bucket.

river on barges which are unloaded at the dock by means of a grab bucket. This bucket delivers into a hopper feeding a belt conveyor as shown in Fig. 1, and the material is delivered by the conveyor to any part of the plant. This conveyor is equipped with carriers and a 20-inch 6-ply special rubber conveyor belt. This conveyor is 290 feet centers; it operates for the first 150 feet on an incline of 20 degrees after

SILENT CHAIN DATA BOOK

Link belt Co., Chicago and Philadelphia. pp. 112. 6x9 in. Flexible Leather.

This engineering Data Book which is stated to be the first ever published will enable users of power to select the correct silent chain drives for their work and determine exact costs from list prices shown in the book.

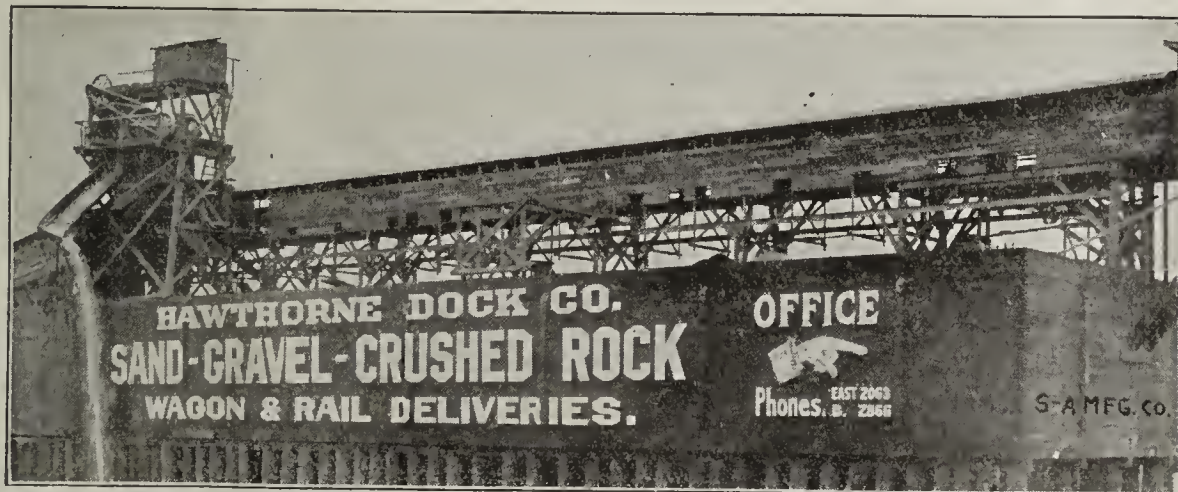


Fig. 2. The Conveyor Is Located Above the Bins. Washing Plant at the Left.

which it takes the horizontal and passes over the various bins, into any one of which the gravel may be discharged as required by a hand-propelled tripper.

A later addition to this equipment is the washing and screening plant seen above the bins. It is so arranged that the tripper may deliver into the hopper of a small bucket elevator which raises the gravel into a screen. This screen is located at a sufficient height above the bins so that the discharge chutes may serve the two bins directly beneath. The elevator used for this washing equipment is 21 feet centers, and it is equipped with 18x9x14-inch continuous buckets. The washing is done in a standard 42-inch by 12-foot No. 9 screen, with a 5-foot jacket. The

Besides giving complete engineering information on silent chain driving in simple and compact form, it describes many uses of silent chain for the efficient transmission of power and gives specific reasons and illustrations showing application in a large variety of uses.

Link-Belt Silent Chain is a series of links connected by joints which consist of segmental case-hardened bushings and case-hardened steel pins. Its rated efficiency is 98.2 per cent on actual test. It will transmit any amount of power quietly.

Copies can be obtained free of charge by addressing the Link-Belt Company, 39th St. and Stewart Ave., Chicago.

Among The Cement Mills

SAN ANTONIO CEMENT MILL

To facilitate the delivery of cement and to do away with delays which have characterized the delivery of cement orders to contractors having municipal work, the San Antonio Portland Cement Company, San Antonio, Texas, has ordered an automatic packing machine. This apparatus will cost \$45,000 and will be installed within the next few weeks. It is now being manufactured and the factory has instructions to rush the machine to San Antonio just as soon as it is completed.

The automatic packer will eliminate the work of dozens of laborers and will pack cement bags and deliver them to the cars in less than half the time laborers can do this work at present. In addition this machine will accurately measure the cement that goes into every sack and as a result short weights and over weights will be eliminated. According to Charles Baumberger, president of the San Antonio Portland Cement Company, the apparatus now ordered is the most modern that can be purchased.

Mr. Baumberger believes that when the packing machine is installed the daily output of the plant will be increased to such capacity that no contractor need fear not getting cement on time to execute his municipal or private contracts.

The purchase of such machinery was made necessary by the great amount of municipal work now pending, likewise by the heavy amount of private construction in sight. Another cause is the difficulty which the company has been experiencing in getting sufficient labor.

"You would be surprised to know," said Mr. Baumberger, "the trouble we have had in employing labor. We have no strike, neither have we experienced a demand for more pay from our employes, but to the contrary, we have suffered from what appears to be indifference on the part of men to work. In order to induce men to work we have been offering double wages, with the extra added inducement of a keg of beer and sandwiches at our expense on Saturdays. The same offer prevailed on Sundays, too, as we have found it necessary to work on the Sabbath in order to keep up with the demand for cement. But despite this scores of our employes have quit, with the result that we have been working short handed for the last few weeks. Knowing that these conditions prevailed we would come down town and hire men and send them out to the plant, but they would never get there. We usually employ 175 men but today we are working only 125.

"The most of our shortage has been in the packing department. We have had no trouble in the engineering or chemical departments, but only in the packing end. This is the difficult end of our work and upon the amount of sacks we pack depends the amount of our deliveries. Because of our labor troubles we were unable to make deliveries two days last week.

"I believe," Mr. Baumberger concluded, "that when we get our new machinery installed we need not expect any further trouble. With the arrival of the new machinery all that will be necessary will be two men to stack the cement in the cars, as the machinery will deliver the bags and barrels right to the cars. Despite our handicaps we have been delivering cement as rapidly as we could. The only paving contractors demanding cement for work now going forward are the Texas Bitulithic Company and we have been giving this firm a car of cement a day for the last three days."

THE CEMENT INDUSTRY IN JAPAN

The manufacture of Portland cement has become one of the greatest of all industries and fortunately has not remained the specialty of any one country. Even as relatively far back as 1871 the Japanese government established a cement factory at Tokio on a very small scale, but it was soon found that for such an undertaking to be more than philanthropic, it would require the right commercial and technical men at the head of it. So in 1883, it passed into private hands. The new proprietor handed the technical management over to a young Japanese engineer, who had acquired considerable practical experience in Europe, and under whose management the output rose in one year from 25,000 to 60,000 barrels. In 1891 a branch was established at Moji, and ten years ago the first rotary kiln was introduced at the Tokyo factory. In 1912 a new factory was established, equipped with all the latest European machinery which brought the output up to a million barrels, but further enlargements will be required and Japanese experts have been touring Europe and America to glean new ideas of improvements.

On the other hand, Japan's export in cement, which in 1911 still amounted to over a million yen, fell in 1912 to 328,000 yen. This is chiefly due to Japan's best customers (Manchuria and China proper), establishing factories of their own, notably the one at Haiphong.—"Le Ciment."

CEMENT MILL NEWS

Atlas Cement Co.

The Atlas Portland Cement Company has called a meeting of shareholders for October 14 to vote on a proposal to authorize the issue of new bonds not to exceed \$10,000,000 and to increase the preferred stock from \$1,500,000 to \$3,000,000. The bonds are to be put out only for the purpose of retiring other obligations of the company or in acquiring new property. The stock will eventually be offered to shareholders at par.

Nebraska Cement Co.

The Nebraska Portland Cement Company, a \$1,000,000 plant, started grinding shale and rock. It is the largest industry outside of Omaha and the only plant in the state making cement.

The buildings are all steel and cement, and modern and up-to-date. There is an unexhaustible supply of cement rock and shale.

Stockholders are mostly Nebraska people and the officers are of Omaha. It is reported they will put in one of the largest water power plants and an electric line of railroad, having bought water power land near Guide Rock last year.

HUNT ENGINEERING CO.

The Hunt Engineering Company, Kansas City, Mo., announces the association with that company of Mr. C. M. Dugan, Jr., as Vice-president. This means the absorption by the Hunt Engineering Company of the interests of the Dugan Engineering Company, which was organized by Mr. Dugan. The increased volume of business in engineering, construction and operation of cement mills, and the material broadening of the scope of the operations of the Hunt company, has made it desirable for it to enlarge its organization in this way.

INTERNATIONAL CEMENT CO.

Charles A. Irvin, general manager and treasurer of the International Portland Cement company, limited, of Spokane, referring to the recent accident which occurred in the clinker storage building at the factory of the company, stated that he had made an examination of the damage caused, and finds it to be much less serious than he had anticipated, and that operations would be delayed in the raw end of the mill for a short time only.

"The accident in no way affected the clinker grinding, packing, or finishing departments of the plant; neither has it interfered with shipments," said Mr. Irvin. "We are in a position to continue the prompt delivery of cement to all of our customers."

Mr. Irvin further stated that the damage caused by the accident at the mill is being promptly repaired, and that the directors of the company have plans practically completed for an additional clinker storage building with a minimum capacity of 150,000 barrels. Construction work on this building will commence in the near future.

CHANCE FOR CEMENT MAKERS

American manufacturers have not yet made the most of their opportunities to establish greater export trade, according to Geo. Otis Smith in Bulletin 599 of the United States Geological Survey. Statistics show that the export of cement from England, Germany, Belgium, and France not only have been considerably greater than those from the United States, but have borne a much higher ratio to the production in these countries. The quantity of cement exported by France in recent years is estimated to have reached at last 23 per cent of her production, and that of Germany about 17 per cent. There are few cement plants in South American countries, and in the past these countries have been supplied mainly from Europe. There is evidently an opportunity now for the cement industry of the United States to secure this trade.

CEMENT COMPANY ISSUES SPANISH CATALOGUE

In its plans to increase its South American export business the Alpha Portland Cement Company, even before the present European disturbance, had prepared a 24-page pamphlet in Spanish. It contains general data on the development of the cement industry enlarges upon the manufacture and uses of Portland cement and shows pictures of a great many prominent American structures in which the Alpha brand has been used. Some information is given, also, on the proportioning of cement. Finally the specifications of the American Society for Testing Materials are added.

The preparation of the pamphlet was completed in advance of the present European war and its issuance was simultaneous with the outbreak of the conflict.

SCHENECTADY, N. Y., TO TEST CEMENT

Hereafter all cement used on city contract is to be tested in the office of the city engineer instead of hiring it done by private corporations in this city or in Albany. This is an innovation, most of this work having previously been done in Albany and none by the city itself. A new Fairbanks testing scale and other necessary apparatus have recently arrived and have been installed in the city engineer's office. A class will be conducted to familiarize the assistant engineers with the process so that each will be able to make the tests, which will be in charge of City Engineer William B. Landreth and Deputy City Engineer W. Earl Weller.

LEHIGH CEMENT RANCH

Following a plan for the conservation of all resources, the Lehigh Portland Cement Company is converting the 8,000 acre tract owned by them near New Castle, Pennsylvania, into a large cattle ranch. Superintendent W. H. Kleckner, of works No. 3, has charge of the project, and has had \$5,000 worth of fertilizer added to the land within the past 3 days. Only first class cattle will be raised, as well as heavy draft horses. For the past number of years the 8,000 acre tract of land, located in this and Butler county, has been sublet to the farmers, the result being that the land, to a certain extent, is run down and in bad shape. For this reason, works No. 3, generally known as "The New Castle Cement Works," has decided to utilize the land by raising horses and cattle thereon. This is a very large proposition as the land has to be enriched by large quantities of fertilizer. About \$5,000 worth of fertilizer and a number of horses were shipped to the land last week. Only enough grain will be raised on the ranch to winter the cattle, 100 of which will arrive in a short time. This number will be greatly increased as the facilities for accommodating them are increased.

Possibilities

Within the next 2 or 3 years it is thought that this will be one of the largest ranches in this part of the country. Already the land contains 10 dwellings, as well as a number of barns, which will be utilized at once. A little delay will be experienced on account of the farmers being allowed privilege of reaping the crops they have already planted, but this will be accomplished by the last of the month. However, by spring the ranch will be partially stocked with the crops planted, which will put it in shape for the cattle that will be shipped later in the year.

This scheme is not a new one by any means with the Lehigh Portland Cement Company. Already they have a number of ranches throughout the middle West, from which they are deriving a handsome income. As they are interested in the manufacture of cement only, having 12 works in operation at present, the limestone deposits on the above-mentioned tract are not to be mined. The rent which they have been receiving from the land hardly equals the depreciation in value caused by constant farming, so for this reason they decided to take charge of it personally. A ranch of this size, when it gets under headway, will be a considerable asset to this community.

PAYS BELATED DIVIDEND

For the first time in several years holders of 7 per cent cumulative preferred stock of the Peninsular Portland Cement company, of Jackson, Mich., are receiving checks covering a 3½ per cent dividend payment.

With the check is a communication from officers of the company explaining that practically all of the concern's obligations have been cleared away and expressing the belief that more frequent distribution of profits will hereafter be made among stockholders.

CRUSHED STONE PLANT

The Higgins Stone Company, Bellevue, Ohio, operate a large crushed stone plant having a daily capacity of 2,000 tons. They use Austin crushers exclusively, manufactured by the Austin Mfg. Co., Chicago, and have one cyclone drill continuously in operation, also a model 60 Marion shovel and a 70-ton Bucyrus steam shovel. This equipment, the Higgins Company declare, is giving good service.

A LITTLE TALK ABOUT IDEAL SERVICE

The object of this little talk is to open the eyes of the prospective concrete, or cement, worker to the possibilities of the wonderful modern business in which he can take a part.

There are several RIGHT ways of doing things.

But there is only one SAFE WAY—that is to know the vital things to do.

However, there are certain things to NOT do and these are equally as important.

The concrete business is young—

And we found the necessity, because of the number of questions that came to us through the mails, of establishing what we are wont to call our "Service Bureau"—really it is an Intelligence Department.

Let us tell you how to go about the task of obtaining knowledge from this department of ours.

Just write us a good, plain, common-sense letter.

Never mind about the frills. Consider only the essential points of our ability to serve you. Think only of your own selfish view-point when penning your letter—ask us what YOU want to know.

Tell us your troubles, if you are already engaged in the concrete business; tell us what you would like to know if you are not, already, in the business.

Anyway, we want to let you have the benefit of our experience—there are lots of things to learn—we have received our knowledge from the men on the firing-line—we'd like to hand it on to you.

There are many men who are engaged in the block business who do not understand the possibilities of the cement tile industry. If you are one of these we have a very important message for you.

We have prepared exact formulae and diagrams that are the result of ripe experience—

We will tell you how all the Dunn machines are interchangeable and interuseable—

We will tell you why the Dunn batch mixers are sold from \$67.50 to \$224 and why they are sold on 15 days' trial.

We will explain why there are no after-parts to buy—all that is necessary in the way of further purchases are additions.

We will tell you how you can make fence-posts that will never decay or deteriorate.

We will tell you how the Dunn Combination Block machine will make three styles of blocks and 150 blocks per day—no chance of any getting damaged.

We have mentioned the word "service" many times in these lines—now we are going to place a different construction upon that word.

We are going to tap you on the shoulder with the word "co-operation."

Of all the intangible, uncertain commodities that can be bought or sold, co-operation is the most uncertain and intangible—

There is no straight-edge that can be placed alongside it—

There is no balance upon which you can weigh it—

There is no measure in which you satisfy its requirements.

Honor and integrity must enter into every transaction if we would succeed.

And this is the reason why we work "for" and "with" those who are even contemplating the purchase of anything in the way of concrete machinery.

We are not satisfied with just merely making a sale—we want the user of the machinery that sale represents to be perfectly satisfied in every way.

We are willing to put a sufficient quantity of our time into the discussion of your proposition—and when we say that we mean it.

All we ask is that you put your time against ours—that you co-operate with us.

Will you do it?

We will look upon it as a special favor if you will look us up in the most rigorous manner.

The more closely you examine our methods and our record the better we will like it—

For the pleasantest moments we know are when some Doubting Thomas puts it up to us to deliver the proofs.

Request us for those proofs.

We'll send them—as we have said, without obligation of any kind. Just write the W. E. Dunn Manufacturing Company, 4139 Fillmore street, Chicago.

"THE LITTLE BOSS IS MAKING GOOD"

The above declaration was recently made in reference to his concrete mixer, by a subscriber who is a contractor and builder living in Alexandria, Nebraska, Mr. L. Landkamer. He sends a photograph of his gang at work laying a new concrete floor in the railroad coal sheds.

It always inspires a good deal of confidence in a machine to have it endorsed by a brother contractor who has given it a thorough test in actual work. Mr. Landkamer is not the enthusiastic user of the "Boss" mixer, nor is the popularity of this machine by any means confined to Alexandria, Nebraska. On a single day this spring, the manufacturers received 32 orders. Their volume of business has kept right up throughout the spring and summer; in fact, there has been such a demand for their machines that they have been forced to run their factory day and night so as to fill orders promptly and not keep any contractors waiting. When a man orders a concrete mixer at this time of year, right in the busy season, he usually wants it in a hurry; and there is a good deal of satisfaction in dealing with a concern that appreciates the importance of prompt delivery and has the manufacturing facilities to turn out high grade machines on time.

As many of our readers know, the "Boss" concrete batch mixers are manufactured by the American Cement Machine Company, Inc., 9635 Johnson street, Keokuk, Iowa. Their plant is right beside the immense new Mississippi dam, which gives them an unfailing source of cheap manufacturing power. This Keokuk dam project has been one of the great engineering accomplishments of the century. It develops 200,000 electric horse power.

We are sure that many of our readers would like to look over the new illustrated catalogues recently issued by the American Cement Machine Co., describing their concrete mixers. The "Boss" is a 5-foot capacity batch mixer, and the "Steel King" a 10-foot mixer. Both are made of steel, and are equipped with the reliable Mandt gasoline engines. Other types of engines can be furnished instead, if preferred. Electric motor power can also be provided. Write the American Cement Machine Co., 9335 Johnson street, Keokuk, Iowa, for full particulars.

PORTABLE BINS

Small jobs of concreting are seldom handled as efficiently as large work because it does not pay to erect material bins for a short period of use. The Weller Mfg. Co., of Chicago, has endeavored to overcome the difficulty by building portable bins for bulk cement, sand and aggregate, which are filled by means of a bucket elevator. This should give practically the efficiency in handling materials afforded on larger jobs. The equipment may be taken down and moved from job on hand with but little lost time in assembling.

HELM BRICK MACHINE

The Helm Brick Machine Co., of Traverse City, Mich., is announcing one or two important business changes.

This firm manufactures the line of Helm Brick and Block Presses which has been successfully marketed for a number of years.

The Helm Brick Machine Co. becomes the successors of the Queen City Brick Machine Co. through consolidation of the two companies which have operated heretofore. Mr. C. J. Helm is President and Manager of the new organization.

The offices of the company are being moved from Traverse City, Mich., to Cadillac, Mich., where the factory is located. In its desire to render the most efficient service to its customers, the Helm Company has deemed it necessary to locate the office in close contact with the factory. This has furthermore been deemed necessary because of the constantly increasing business and also owing to the development of new machinery.

The Company is now about ready to announce to the trade a line of batch concrete mixers for hand and power operation and a new brick and block press which will sell at a remarkably low price.

All correspondence in the future should be addressed to the Helm Brick Machine Co., Cadillac, Mich.

SAND AND GRAVEL NEWS

Alleging that the various dealers in washed river sand and gravel of the city of Portland, Oregon, have formed a combination in restraint of trade and that the alleged trust has destroyed the business of the Peninsula Sand & Gravel Company, which concern

they absorbed, and injured the business of the plaintiff company, the Oregon Sand & Gravel Company started suit yesterday for \$200,000 in the Circuit Court.

Numerous unlawful actions are accredited to the defendants in the complaint. The defendants named in the complaint are: The Bates Sand & Gravel Co., the Hawthorne Dock Co., Columbia Contract Co., Pacific Bridge Co., Portland Sand Co., Columbia Digger Co., Nickum & Kelley Sand and Gravel Co., Star Sand Co.

The complaint alleges that prior to the forming of the alleged sand trust the price of delivery and purchase of sand and gravel was only 50 cents a yard. Since then, it is declared, the price has increased greatly.

The complaint alleges also that discrimination is shown.

The complaint charges John Kiernan, one of the defendants and who is said to be the owner of Ross Island, with aiding the alleged sand trust to destroy the business of the Peninsula Sand & Gravel Company. According to the suit, the Peninsula Company had been digging sand from the shores of Ross Island and had been paying Kiernan 6 cents a yard to meet a large contract, when, without warning or assigning any reason, Kiernan, the complaint charges, ordered the concern to stop digging.

The plaintiff company charges that the defendants have complained to the United States War Department with the purpose of harassing and intimidating the concern. The complaint further alleges that the alleged trust caused false rumors to be circulated as to the financial condition of the plaintiff company and thereby causing, the complaint states, the F. T. Crowe Company, building material dealers, to withdraw its financial support from the plaintiff concern.

Stop Shoveling Your Profits Away



Get the Time-Saving, Substantial, Reliable, Economical Van Duzen Mixer, with or without side loader, used by hundreds of large and small contractors. Capacity 50 to 80 yards per day. Both the Price and Cost of Operation will surprise you.

Manufactured under Basic, U. S. Letters Patent
Jan. 24-05, Feb. 14-05, Jan. 29-07.

Our catalog fully describes these machines

The Van Duzen-Roys Co.
4th Floor, Hartman Bldg., Columbus, O.

Champion "Lightweight" Mixer

Hundreds of them now being used—every one proving satisfactory—owners would not part with them for twice what they cost.

THAT TELLS THE STORY.

5-Foot

BOSS

"Highway
Special"

with

3H.P. Mandt
Engine



Low Loading Measuring Hopper gives this MIXER the speed of a side loader.

A Batch of "40 Times Mixed" Concrete a Minute

For long hauls over rough roads this outfit can't be beat—high wheels with wide tires, standard wagon track.

Hoist or Power Loader Can Be Attached

Price is Lowest
Ever Made

Strongest Guarantee
Ever Written

Steel King
10 FOOT SIZE

A LARGER MIXER
AT A LOW COST
BUILT OF STEEL

1000 pounds less material to pay for and drag around.

Write for illustrated catalogs

THE AMERICAN CEMENT MACHINE CO., Inc.
9635 JOHNSON ST. KEOKUK, IOWA

INVESTIGATION AND EXPERIENCE ARE PROVING THE RELIABILITY OF HYDRATED LIME FOR WATER PROOFING CONCRETE WORK. IT IS NOT ONLY THE BEST BUT THE CHEAPEST WATER PROOFING COMPOUND KNOWN.

Architects, Engineers and Contractors everywhere are being interested in and are investigating the worth of Hydrated Lime as a water proofing. Experience and actual application are proving to them beyond shadow of doubt that Hydrated Lime is reliable, permanent and harmless.

Concrete Tank for Smudge-Pot Distillate in California

Reservoir Oil-Proofed by Adding 10 Per Cent of Hydrated Lime to Concrete.

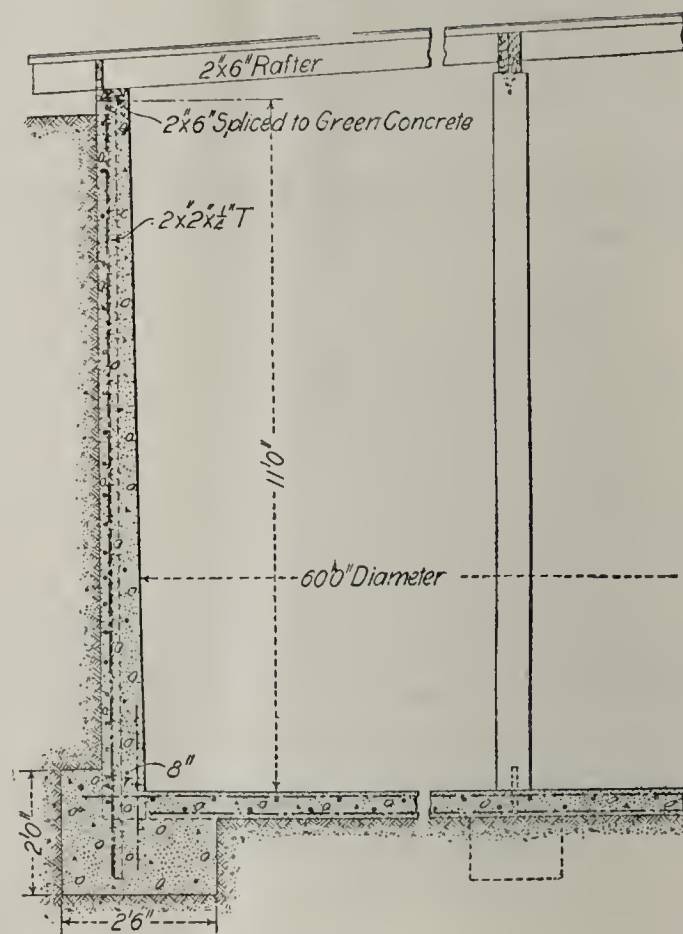
ABSOLUTE assurance of having material on hand for smudging in the citrus belt of Southern California, when a falling temperature requires this measure, has led to the storage on the ground of "slop distillate," a local name for the low grade oil used in the smudge pots. Many supplies for the individual grower are handled by the association which packs and sells his output. At Narod the West Ontario Citrus Association has recently constructed a reinforced-concrete distillate reservoir of 235,000-gal. capacity, sufficient to carry the orchards over the low-temperature period. It is 60 ft. in diameter and 11 ft. deep.

Many attempts have been made with varying degrees of success in building reservoirs of concrete which would be impervious to oil, as even the heavy grades of crude oil will permeate walls which are watertight, but the lighter grades of oil and distillate are harder to confine. The engineers report that the Narod tank has been filled with distillate for more than six months without any evidence of seepage.

A section of the wall is shown herewith. Eight 6x6-in. redwood posts, 15 ft. from the center post, support the composition roof laid on top of $\frac{7}{8}$ -in. sheathing.

The floor is reinforced top and bottom with $\frac{1}{2}$ -in. rods spaced on 12-in. centers both ways. The concrete block under the wall extends 8 in. beyond the outer edge of the wall and has a rim against which the 8-in. non-battered wall abuts. Horizontal wall joints at the end of a day's run consisted of a bond of No. 27 galvanized iron sheet 6-in. wide, embedded half its width in each day's work.

Oil-proofing was accomplished by adding 10 per cent of hydrated lime to the concrete during the mixing operation. Mayberry & Parker, architectural engineers, of Los Angeles, designed the tank, which was built by L. Fleming of Pomona, Cal.



SECTION THROUGH WALL OF NAROD TANK

See next page for list of lime manufacturers who make hydrated lime and who will gladly furnish you samples, circulars and any information you desire.

RAYMOND W. DULL

One of the best known men in the engineering, contracting, designing and equipping of a sand and gravel plant, is Raymond W. Dull. Scattered about the country are examples of his skill. He is known as one of the most expert men in the business. He is a graduate from the University Engineering Department at the University of Illinois, having received the degree there in June, 1910, after a general view of work. He is a member of the American Society of Mechanical Engineers, and the Western Society of Mechanical Engineers. He is an associate member of the National Association of Sand and Gravel Producers. Since his graduation he has made a specialty of conveying, transmission and screening machinery. He designed and handled the Tompkins-Cove Stone Company's plant, which is the largest stone crushing plant in the world, having a capacity of 10,000 tons a day. He designed the conveying system of the Copper Queen Consolidated Mining Company's Sacramento shaft, the first system of the kind for handling copper ore direct from the shaft. He designed the conveying system which drains the material for the large irrigation dam at Milner, Idaho. This is one of the largest earth dams ever built. It is 143 feet high, 2,000 feet long and the base covers 12 acres. He handled the first big steel conveyor which carried the crusher stone from Edison's giant rolls, as well as several since for the same purpose. Mr. Dull had charge of the engineering department of three prominent manufacturing companies previous to starting the present company of

Raymond W. Dull & Co., 1912-14 Conway building, Chicago. This company makes a specialty of equipping sand and gravel shafting plants, stone crushing plants and conveyor systems.

ELECTRICAL INDUSTRY

"The Young Man and the Electrical Industry" is the title of a story written by James H. Collins, the well known magazine writer, which has just been issued by the Westinghouse Electric & Manufacturing Company.

The little book deals with the opportunities afforded a young man in this industry and the different lines in which he may direct his activities as exemplified by the works of the Westinghouse Electric Company.

The company announces that it will supply a copy to anyone interested in the development of young men.

TOOLS FOR CYCLONE DRILLS

Cyclone Drill Co., Orrville, Ohio, has issued a handsome new catalogue of "Cyclone Cable Tools," Catalogue C-35 illustrating and describing its drilling machinery and tools of the hollow rod and cable types, for all kinds of sounding, boring, and blast-holes. The company issues a book on "Drill Work, Methods and Cost," of 344 pages, with illustrations and tables that is a complete treatise on the subject. Price is \$5. A copy is given free to every purchaser of a Cyclone drill, or of tools amounting to \$50.

HYDRATED LIME

Its Marvelous Increase in Consumption

is due to its successful and growing use in various kinds of cement work. It is only necessary to mix the two and any desired proportions can be employed. For laying brick and stone a mixture of 25 parts cement and 75 parts hydrated lime is quite popular. (One bag of cement to three 100-lb. sacks of hydrated lime.) The addition of the cement does not appreciably detract from the plasticity of the mortar, while it adds greatly to the strength, particularly at early periods. For stucco, the proportions are generally reversed, (one 100-lb. sack of hydrated lime to three sacks of cement,) the hydrated lime adding to the plasticity of the mortar and making it spread more easily. It also makes a lighter colored stucco and adds to its density. For making concrete building blocks, about 15 parts of hydrated lime and 85 parts of cement are used (or one 40-lb. sack of hydrated lime to two sacks of cement.) It has been found that up to 15% of hydrated lime does not detract from the strength of cement mortars.

Write for printed matter, information, etc., to any one of hydrated lime manufacturers listed below—the nearest to your city

LONGVIEW LIME WORKS,
BIRMINGHAM, ALA.

CHARLES WARNER CO.,
WILMINGTON, DEL.

MARBLEHEAD LIME CO.,
CHICAGO, ILL.

OHIO & WESTERN LIME CO.,
HUNTINGTON, IND.

SECURITY CEMENT & LIME CO.,
HAGERSTOWN, MD.

LEE LIME CO.,
LEE, MASS.

CHARLEVOIX ROCK PRODUCT CO.,
CHARLEVOIX, MICH.

WHITE MARBLE LIME CO.,
MANISTIQUE, MICH.

GLENCOE LIME & CEMENT CO.,
ST. LOUIS, MO.

DUTCHESS COUNTY LIME CO.,
DOVER PLAINS, N. Y.

ROCKLAND & ROCKPORT LIME CO.,
101 PARK AVE.,
NEW YORK, N. Y.

KELLEY ISLAND LIME & TRANSPORT CO.,
CLEVELAND, OHIO

NATIONAL LIME & STONE CO.,
CAREY, OHIO.

JOHN D. OWENS & SON CO.,
OWENS, OHIO.

NATIONAL MORTAR & SUPPLY CO.,
PITTSBURG, PA.

GAGER LIME & MFG. CO.,
CHATTANOOGA, TENN.

DITTLINGER LIME CO.,
NEW BRAUNFELS, TEX.

ROUND ROCK WHITE LIME CO.,
ROUND ROCK, TEX.

RIVERTON LIME CO.,
RIVERTON, VA.

INTERNATIONAL LIME CO.,
SUMAS, WASH.

STANDARD LIME & STONE CO.,
FOND DU LAC, WIS.

UNION LIME CO.,
PARST BLDG.,
MILWAUKEE, WIS.

NEW CEMENT BRICK MACHINE

The Besser Manufacturing Company, 405 Fourteenth street, Alpena, Mich., who have recently placed a very successful brick machine on the market for making cement brick have the following to say concerning this machine which is illustrated herewith: "The cement brick business hasn't prospered like the block business. That's because the cost of cement brick at the factory has been too high. The hand brick machine and some of the power brick machines have made a good product, but it couldn't compete with common clay brick."

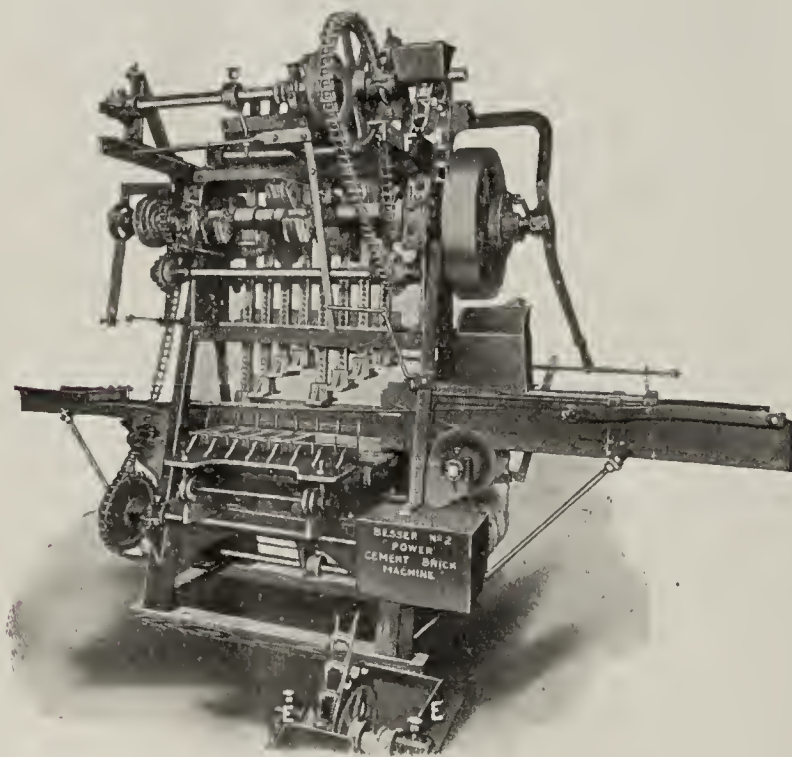
The Besser Power Brick Machine has a capacity of from 50,000 to 60,000 brick per day. These brick are being made on this machine for from \$3.50 to \$4.50 per thousand. They compete in price and excel in quality the clay brick made by the old-fashioned, expensive kiln-burning methods.

This machine tamps the cement mixture into brick molds. The mixed material is elevated into a hopper, which feeds into sets of molds revolving on a cylinder. These molds pass under automatic power tampers which tamp the molds full. The surplus mixture is scraped off automatically, the face of the brick is troweled and two mechanical arms pick up the pallet-full and deposit it on the kiln car.

No human hand touches the material from the mixer to the curing rooms—the machinery does it all.

The result is a dense cement brick, hard as flint. It is stronger, more water-proof than a clay brick and can sell for the same, or a lower price.

We make a machine of smaller size with a capacity of 25,000 brick per day. Ask for our Power Brick Machine catalog.



Herman Besser, president of the Besser Manufacturing Company, states further regarding the brick machine: "I'm proud that I built a machine that will make good, honest, strong, waterproof cement brick that can meet clay brick prices right next to the clay brick yard."

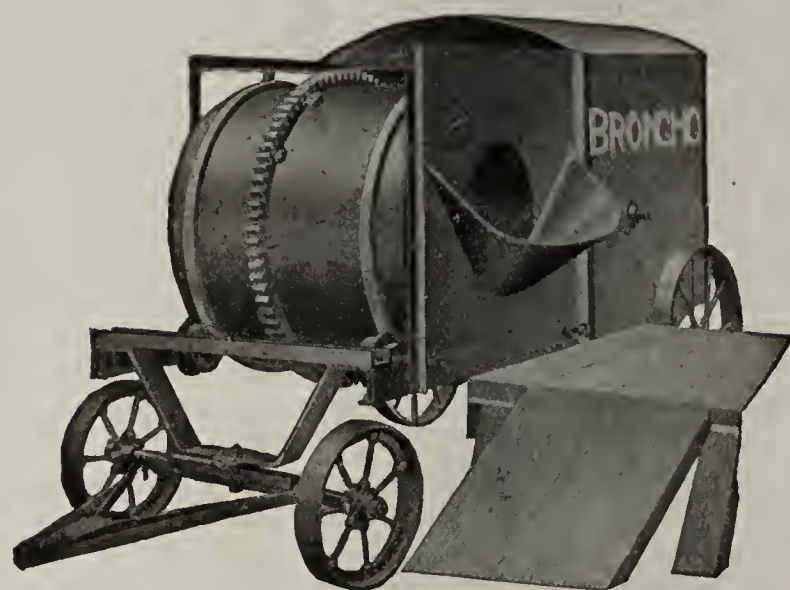
"But I'm prouder of the fact that I have lighted on the only correct principle of molding concrete. That's a feature of this brick machine."

"The hopper feeds into the mold more concrete than is needed. Each brick is tamped by a separate, independent tamper. This tamper tamps the concrete until the mold—every corner of it—is full. Then the surplus is scraped off. You can't measure concrete into a mold and then apply pressure enough to make

the concrete just fill the mold—mixed concrete can't be measured that accurately. You can't push it into the mold—one brick would be too large and the next one would be porous. You've got to feed more concrete than you need—let the variation of amounts be in the surplus, not in the product."

LANSING BRONCHO BATCH MIXER.

The Lansing Company, 747 Cedar street, Lansing, Mich., has sent us an electrotpe and description of their new 1914 model Broncho batch mixer which we publish herewith. It is made in sizes 7 to 10 and has 15 cu. ft. capacity. They declare it is better than the best and only costs a fraction as much. It is "the daddy of all mixers."



A strong, powerful mixer. Not a cheaply-made machine at a cheap price, but a high grade, first class mixer at a popular price. A machine every contractor will be proud of. Strong where strength is needed. High wheels for easy moving; low intake for quick, easy loading; high discharge for wheelbarrows or forms. Easily cleaned; quickly and easily moved. Equipped with all of the latest and most modern devices, and built on the most modern and sensible lines, combining few wearing parts with great strength and speed.

No other mixer combines all of these features. Low charging for wheelbarrows or shovels. Measuring hoppers for those who want them. Side loaders for big jobs; high discharge for wheelbarrows or forms; simple, strong, powerful engine; non-slopping rings; quick mixing principles; ball and socket fifth wheel for short turn, and to avoid racking of frame on uneven ground; few wearing parts for economical up-keep; high wheels for hauling steel drum; machined bearings; steel channel frame; friction clutch for starting and stopping; quick mixing, cleaning and dumping principles. Most mixers have some, but the Broncho combines all of them—the most satisfactory machine made from every required standpoint.

1914 models are marvels of strength and speed. They produce a quality of mix that every inspector accepts and pronounces *good* doing it at most satisfactory rate of speed—500 batches and over per day, if required. Discharge operated instantly without the usual slopping. Mixer is reinforced, braced and strengthened at every possible wearing point. Machined track and bearings; channel iron frame (cross and corner braced), insuring the longest possible and greatest wear. Designed to carry loads of from 1,000 to 5,000 pounds of concrete every batch, 10 hours a day, and 365 days in the year. Adopted by the largest and most exacting contractors in the country.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for \$1.00;
all other countries, \$1.00 per year.

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month, as hereafter our magazine will appear on the 5th of the following month.

Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, NOVEMBER, 1914

PROSPERITY

Business in the United States is sound. America faces her greatest commercial opportunity. This country is on the eve of an awakening—due to a wholesome state of affairs at home and to a condition abroad that will establish our trade supremacy beyond question. The above statements represent a summary of the replies received by the Taylor-Critchfield Corporation, advertising agents, Chicago, to telegrams addressed to some of the leading business men of the United States. Their answers ring with optimism—hope—assurance—confidence.

Business must be good. Proof of prosperity is found in the following messages:—

E. Mapes, Secretary,
Cream of Wheat Company,
Minneapolis, Minnesota.

"I see no reason why, if business is not hampered for political reasons, the United States should not see great commercial prosperity during the continuance of the European war. This, however, is a time when the utmost latitude should be allowed by the government to all legitimate business interests. Upon that, coupled with wise action toward the establishment of mercantile marine and adequate banking facilities, I think the question depends entirely. I think this is the greatest chance for the American manufacturer and businessman that will probably come in several lifetimes, and think the business man of the United States can be safely trusted to take advantage of it if not hampered too much by unreasonable government restrictions. Of course there will come a reaction after the war, and how much the same will affect the United States depends entirely upon how firmly we have established our footing during the continuance of the war period."

Windsor T. White, President,
The White Company,
Cleveland, Ohio.

"Business with the White Company has steadily improved since the scare following the first announcement of war abroad. I believe general business will continue fair in this country and will boom if our surplus farm products and manufactures can be shipped to other countries."

United Cigar Mfrs. Co.,
New York City.

"In the main the present disturbances in American business are due to financial and merchandising readjustments made necessary by the European upset. This readjusting process is already well under way. In the meantime it would be a mistake to fear that the real fundamentals of American business are endangered. Even the cotton losses are already offset by grain increases. American business will emerge stronger from the present crisis than ever before, while other countries now at war will emerge badly weakened. Speaking for ourselves, we are following our normal progressive policy."

Frank D. Blake, Adv. Manager,

Deere & Co.,
Moline, Illinois.

"Agriculture is the basis of our wealth. With the greatest number of bushels of foodstuffs in our history and the best prices in years, our people will save money, materials and wealth. There is a chance for greater expansion. Our factory products will be in demand, our people profitably employed. We are a great agricultural people, at peace with the whole world."

E. C. Simmons,
Simmons Hardware Company,
St. Louis, Missouri.

"General business is absolutely sound and healthy. There need be no fear or apprehension about it. Our August business will I think show the largest sales of any August for fifty years, with promise of better business later."

John Clay, Pres.,

Clay, Robinson & Co.,
Chicago.

"The livestock business is not suffering from the effects of the war. It is likely to be benefited, as a continuance of the fighting will tend to increase the demand for our products. We are decidedly short of cattle and sheep, with a fair supply of hogs, the latter depending automatically on the corn crop. We are dealing in a product needed every day and the country cannot afford to have the streams of production and consumption seriously interfered with. In my judgment we are at the beginning of a long war which will only end by exhaustion. The enormous resources of the conflicting parties point this way. The United States is certainly at the gate of opportunity and by honest and upright dealing, payment of her just debts, even although other nations are tardy, she will gain immense benefits in credit and trade by a wise and liberal policy."

C. A. Patterson, Pres.,
Peoria Drill & Seeder Company,
Peoria, Illinois.

"Close attention to business and the new necessity caused by the existing conditions abroad will keep farm and factory busy. Opportunity has been unexpectedly forced upon the inventive minds of American business men and the splendid results of their accomplishment will be a surprise to other nations and an appreciable financial benefit to the United States."

CONCRETE for
PERMANENCE

The Hydration of Hydraulic Cements.

By Dr. F. Blumenthal.

(Translated by Dr. W. Michaelis—Continued from page 273.)

Stains Applied to the Products of Hydration of Portland Cement.

The formerly described stains were applied to the hardening Portland cement preparations in the following way: The films of paraffine and lacquer covering the cover glass of the slides were carefully removed with a thin knife blade at the two places opposite each other without moving the cover glass, thus preventing crushing of the crystals. Then the fluid still adhering to the preparation was absorbed with filter paper and the stain was allowed to take its place. Hereafter, the cover glass was sealed again in the manner previously described.

Separate samples of perfectly hardened Portland cement were thus treated with the following stains:

1. With anthra-purpurine in lime-water solution. This was allowed to act upon the preparation for a day. Then the surplus of stain was removed by absorbing it with filter paper. The entire preparation proved to be stained red. The large hexagonal crystals, the fine needle-crystals and the colloidal mass were found to be especially highly colored. Hence, all these formations contain calcium oxide in one form or another. The behavior of anthra-purpurine upon preparations not yet fully hardened was likewise observed; in these needle and plate-crystals had formed, but not colloids as yet. In this instance, the crystals had so completely absorbed the stain that the fluid was almost colorless.

2. With patent-blue solution. Only a few hours sufficed to show that the fluid became more and more colorless, whereas the hexagonal plate-crystals became gradually intensely blue. After a day, they possessed a beautiful dark-blue color. The stain could not be removed from the plate-crystals by washing with water. Consequently they contain alumina. The colloidal mass was not stained the least by patent-blue.

3. With neutral methylene-blue solution. The stain spread out uniformly over all formations of the preparation. This did not change even after a day, when the stain could be easily removed by absorption with filter paper, which proved that free colloidal silica had not been formed.

4. With acetic acid methylene-blue solution. The crystals, especially the fine needle-crystals, were soon destroyed by the acid. Therefore, the observation with this stain had to be conducted in a slightly different way from the former practice. The cover glass had to be opened at two places opposite each other and the slide was placed under the microscope in position for observation. Then the stain was allowed to enter. This enabled the observer to see that the droplets of colloids were colored the instant the stain reached them. If the stain reached the needle-crystals they dissolved gradually, turning blue at the same time, but still kept their shape for a time. The more acid came in contact with them, the more readily they were absorbed, so that soon they could not be distinguished from the blue colloidal mass of cloudy appearance forming the background. Hence, both the needle-crystals and the colloidal mass contain silica.

5. In the same way as stated under 4, that is to say, while being observed under the microscope, one slide was treated with potassium ferro-cyanide solution and another with potassium ferri-cyanide. In every instance several spots of blue became visible, a

sign for the presence of iron as peroxyde and ferrous oxide. However, well-formed crystals of Portland cement did not turn blue with the aid of these reagents.

The qualitative composition of the products of hydration of Portland cement, therefore, has been established beyond doubt by their conduct towards these staining reagents; namely, the fine needle-crystals, as well as the colloidal mass consist of calcium silicate, the thin hexagonal plate-crystals are free of silica; they are composed of calcium aluminate, and the large hexagonal crystals are calcium hydrate. These results are verified by the following observations made on artificial fluxes of calcium aluminates and calcium silicates.

The Hydration of Fluxes of Known Composition

The quantitative composition of the products of hydration was studied by comparing preparations made from fluxes resembling in their composition those of the clinker as closely as possible.

These fluxes were made in Fletcher furnaces in which the required temperature of 1600 centigrade could easily be obtained.

The raw materials, chemically pure calcium oxide, alumina and silica, were ground very finely, intimately mixed and stirred with water to a stiff dough.

These mixtures were placed in magnesia crucibles and the latter, for safety's sake, put in fire-clay crucibles, which were exposed to the direct heat of the Fletcher burner.

In several instances, the magnesia crucible did not withstand the high temperature, but was fused with its contents. In these cases we had to employ special crucibles as they are in use for fluxing glass.

Only the core of the flux was used in order to avoid possible contamination from the wall of the crucible.

Calcium Aluminates: In order to check observations made by Keisermann the following mixtures of calcium oxide and alumina were fused:

1,5 CaO . Al₂O₃
2 CaO . Al₂O₃
2,5 CaO . Al₂O₃
3 CaO . Al₂O₃
3,5 CaO . Al₂O₃

These fluxes, examined under the microscope, proved to be of granular appearance; they were not glassy. They hydrated all under formation of hexagonal plates, which showed the most perfect development in the flux 3 CaO . Al₂O₃.

The growing of the crystals could plainly be observed under the microscope, as it proceeded very rapidly. Plate-crystals developed on the surface of the grains of clinker and increased in volume considerably within half an hour. At many of them it could be ascertained after this time that they were of hexagonal shape. In the course of several hours they had developed beautifully. Partly they stood on edge and offered the same picture as we had formerly observed in the case of Portland cement; they were likewise double-refracting.

In time, the entire fused mass developed into crystals of this kind, which cannot be anything but tri-calcium aluminate, as in the first three preparations, containing less than three molecules of calcium oxide to one of alumina, plate-crystals were not as numerous as in the case of the fourth flux. The higher the contents of calcium oxide, the more numerous were the plate-crystals. However, preparations originating from fluxes with more calcium oxide than the tri-

calcium aluminate showed, in addition to the formation of plate-crystals, large hexagonal crystals of calcium hydrate, a sign that they contained a surplus of lime.

The thin hexagonal plate-crystals were stained by anthra-purpurine and patent-blue solutions exactly in the same way as the corresponding crystals in the Portland cement slides. Hence, these are identical with those prepared artificially and must possess the composition $3\text{CaO} \cdot \text{Al}_2\text{O}_3$.

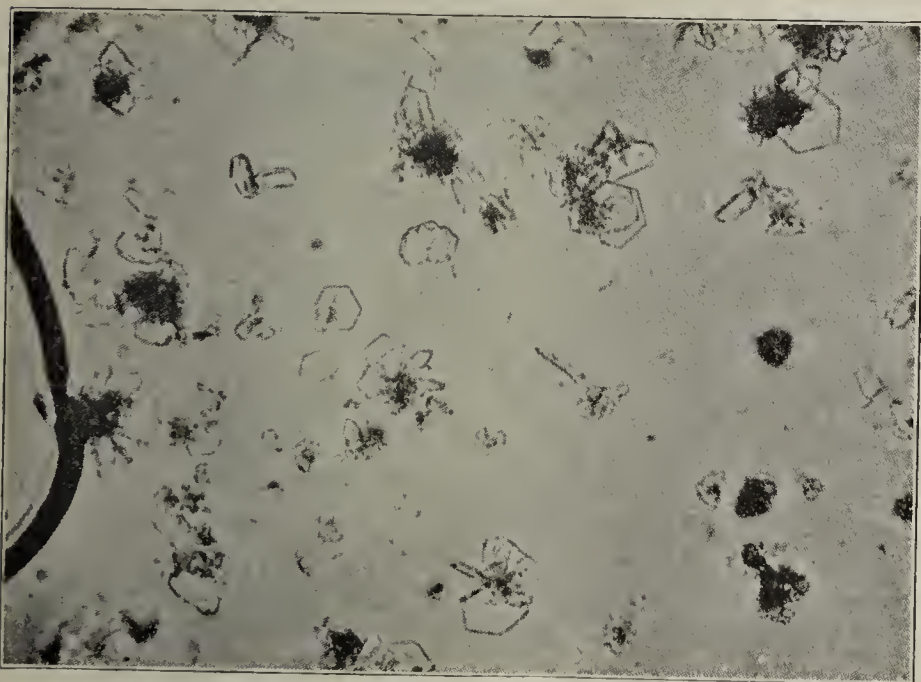
Cut 4 is a good illustration of these aluminate crystals from artificial fluxes which leave no doubt that they are identical with those found in Portland cement. Formation of colloids never occurred in these preparations, not even after several months.

Calcium Silicates: Of the lime and silica mixtures the following fluxes were prepared:

- 1 $\text{CaO} \cdot \text{SiO}_2$
- 2 $\text{CaO} \cdot \text{SiO}_2$
- 3 $\text{CaO} \cdot \text{SiO}_2$

These fluxes, examined under the microscope, showed a glassy structure. Preparations made from the second and third fused mixtures showed after several days large hexagonal crystals, the same as observed in Portland cement, while the first mixture, the mono-calcium silicate, did not show crystals. In addition to hexagonal crystals, fine needle-crystals developed and later on also a colloidal mass. The best microscopic pictures were obtained from the second flux, the di-calcium silicate. As early as the second day, the formation of numerous fine needle-crystals could be observed which protruded in all directions from the grains of the finely ground flux. They grew steadily from day to day and showed, as those observed in Portland cement, negative double-refraction. On the third day, a colloidal mass began to be formed which in the course of time developed in the same way as that seen in Portland cement.

A similar preparation was completely stained by anthra-purpurine solution, especially the fine needle-crystals, if the stain was allowed to react upon a preparation only a few days old in which the colloidal mass had not fully developed. Neutral methylene-blue solu-

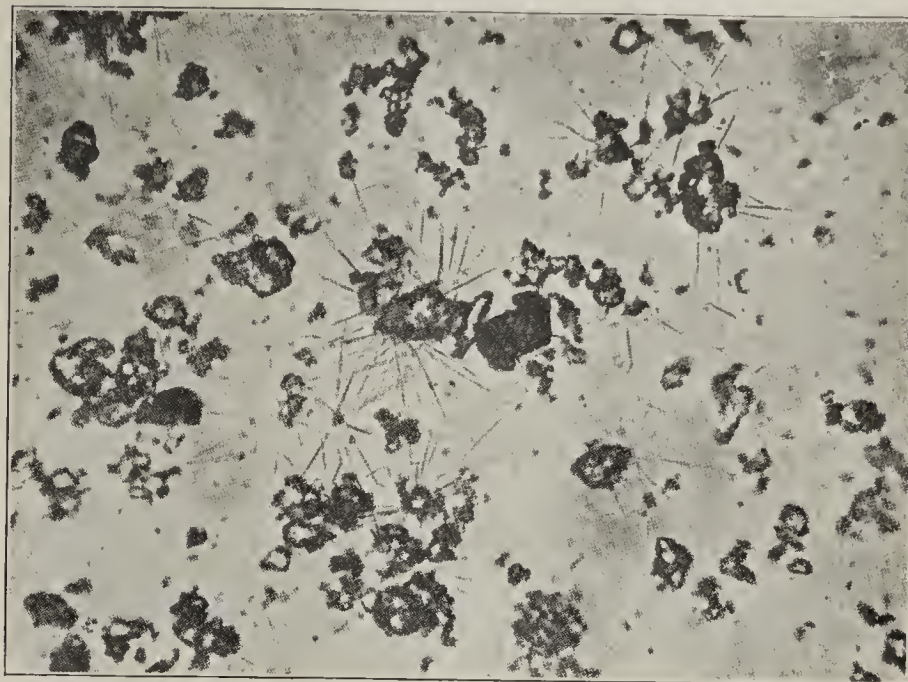


No. 4. Plate Crystals of Calcium Aluminate Obtained from Fused Tri-Calcium Aluminate.

tion was without influence on any parts of these preparations; hence, free colloidal silica is not contained in them. Acetic acidous methylene blue stained dark-blue the needle-crystals as well as the colloidal mass. Both, therefore, contain silica in combination with lime.

Jordis & Kanter's researches enable us to draw some conclusion as to the quantitative composition of

these two products of hydration. These experimenters invariably obtained mono-calcium silicate in the course of their efforts to obtain calcium silicates that are soluble in water. Hence, only this silicate can be formed by re-crystallization or during the precipitation of colloids. Both products of hydration, needle-crystals as well as colloidal mass, show the same chemical and optical behavior in slides originating from artificial fluxes and from Portland cement; consequently, they must be identical.



No. 5. Needle Crystals of Calcium Silicate from Fused Di-Calcium Silicate.

Cut 5 illustrates the products of hydration of the di-calcium silicate. The needle-crystals are very well developed. The colloids shown on the cut do not appear as droplets, but rather as cloudy masses, because the microscope was focused to show the needle-crystals distinctly.

Calcium Ferrites: In the opinion of most experts, iron occurs in Portland cement principally as peroxide combined with lime as calcium ferrite. Michaelis succeeded in obtaining tri-calcium hydro-ferrites by agitating colloidal iron hydroxide with a surplus of lime-water. For our purposes, the following three mixtures of lime and iron oxide were fused:

- $\text{CaO} \cdot \text{Fe}_2\text{O}_3$
- $2\text{CaO} \cdot \text{Fe}_2\text{O}_3$
- $3\text{CaO} \cdot \text{Fe}_2\text{O}_3$

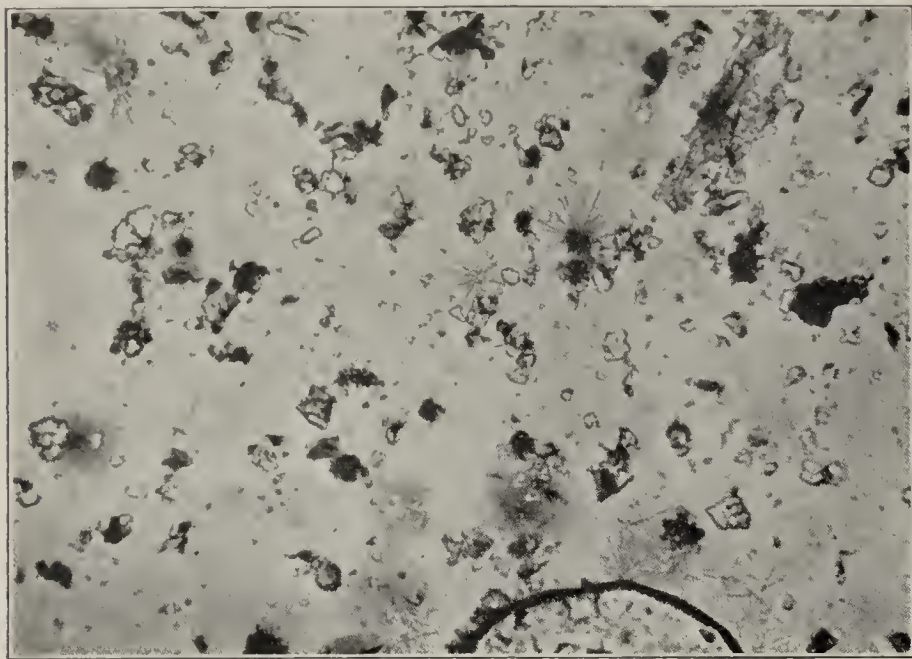
All three fluxes represented granular dark-brown masses. Examined microscopically, the powder appeared as glassy fragments with sharp edges. Most pieces showed double-refraction.

The slides originating from all of these fluxes revealed, after three or four days, star-shaped formations of long flat crystals which grew either from a grain of the flux or had formed independently from it. These star-shaped clusters of crystals were especially common in the last flux, the tri-calcium ferrite. Many of these formations resembled very much the calcium aluminate plate crystals. They were strongly double-refracting and possessed a greenish iridescent color.

These crystals were characterized as ferri-compounds by slightly acidous potassium ferro-cyanide solution. As formerly stated, the slides were opened at two places opposite each other and placed under the microscope. Then, the solution was allowed to enter, while the reaction was closely watched through the microscope. The clusters of flat crystals could be seen to be stained dark-blue as soon as the solution reached them. This formation of Berlin Blue is a positive proof for the presence of iron in the state of peroxide. Further action of the acidous fluid upon the

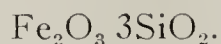
crystals resulted in their destruction. The observation that these crystals were most numerous in the third flux admits the conclusion that they are composed of tri-calcium ferrite.

Also in Portland cement we succeeded in proving the presence of iron peroxide compounds with the aid of the last-described reaction, however it was difficult to ascertain whether these iron compounds were present as well-formed crystals.



No. 6. Needle Crystals of Ferrous Silicate.

Iron Silicates: Only few experimenters have given it a thought whether or not iron oxide and silica combine in cement and, in the process of hydration, form iron silicates. In order to ascertain this the following flux was prepared:



Microscopic slides made from this ground flux showed the interesting fact that as early as 24 hours after being mixed with water beautiful needle-crystals appeared which in most instances formed clusters radiating from a common center. They resembled closely the calcium silicate crystals shown on cut No. 1, that is to say they were likewise very thin and possessed negative double-refraction. Cut 6 gives an excellent illustration of these clusters of crystals.

With a view to ascertaining the chemical composition of these needle-crystals, at first acetic acidous methylene blue solution was allowed to act upon a slide. The crystals which were reached by the fluid were stained blue and slowly destroyed. Finally, they were converted into blue drops having the appearance of colored colloids. This shows that the needle-crystals contain silica. Whether the silica was combined with iron oxide was determined with slightly acidous potassium ferro-cyanide solution. This reagent destroyed the needle-crystals but did not color them. However, the undecomposed grains of the flux were stained blue.

In the same way another preparation was treated with slightly acidous potassium ferri-cyanide solution which stained the needle-crystals dark-blue. They finally dissolved into a blue liquid, whereas the remaining formations did not show the least discoloration. Hence, the needle-crystals contain iron as ferrous oxide and the iron oxide must have been reduced during the fluxing.

A flux answering the composition $2 \text{FeO} \cdot \text{SiO}_2$ was not acted upon by water, not even after several months. This admits the conclusion that iron oxide combines with silica only, if it is reduced in the fluxing process. In the manufacture of cement, and especially during the process of making blast furnace slag

cements, such reduction always occurs in a greater or lesser degree; therefore, it must be concluded that in the hydrating process of cement a similar reaction between ferrous oxide and silica may take place and most likely will take place.

Later on, we actually succeeded in proving the presence of clusters of needle-crystals of ferrous silicate in blast-furnace slag cements with the aid of the Berlin Blue reaction.

Baryta, Strontium and Magnesia Cements: In order to complete the foregoing tests, mixtures of silica and alumina on the one hand and baryta, strontium or magnesia on the other, were made and fused. These three elements can only act as bases with silica and alumina as acids; they may possibly take the place of calcium oxide.

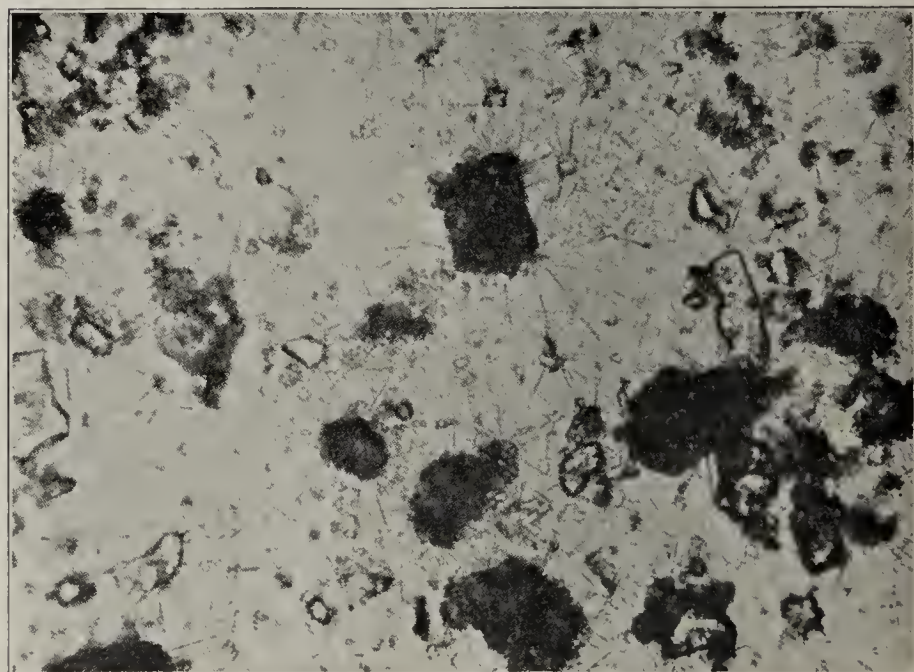
The following mixtures were prepared:

BaO 66%	SrO 66%	MgO 66%
SiO ₂ 23%	SiO ₂ 23%	SiO ₂ 23%
Al ₂ O ₃ 10%	Al ₂ O ₃ 10%	Al ₂ O ₃ 10%

It was very difficult to clinker these mixtures completely. They could invariably be divided into two parts, a vitrified core and an exterior part which, upon cooling, crumbled into a loose powder.

In accordance with the methods previously employed, preparations were made of these calcined mixtures of the loose portion as well as of the vitrified core. The former part, examined under the microscope, appeared as irregular crumbs; the vitrified part, however, resembled sharp-edged fragments of broken glass. All these slides did not show the least change even after several months; neither crystallization nor formation of colloidal bodies took place. Hence, barium, strontium and magnesium do not take an active part in the setting and hardening of cements. Though barium and strontium may possibly act in cement advantageously by converting sulphuric acid into insoluble form, thus preventing injurious action of the latter.

Blast Furnace Slag Cements: Until recently, blast furnace slag had been a waste product in the manufacture of iron. However, the discovery that it possesses hydraulic properties under certain condi-



No. 7. Needle Crystals of Calcium Silicate in Slag Cement.

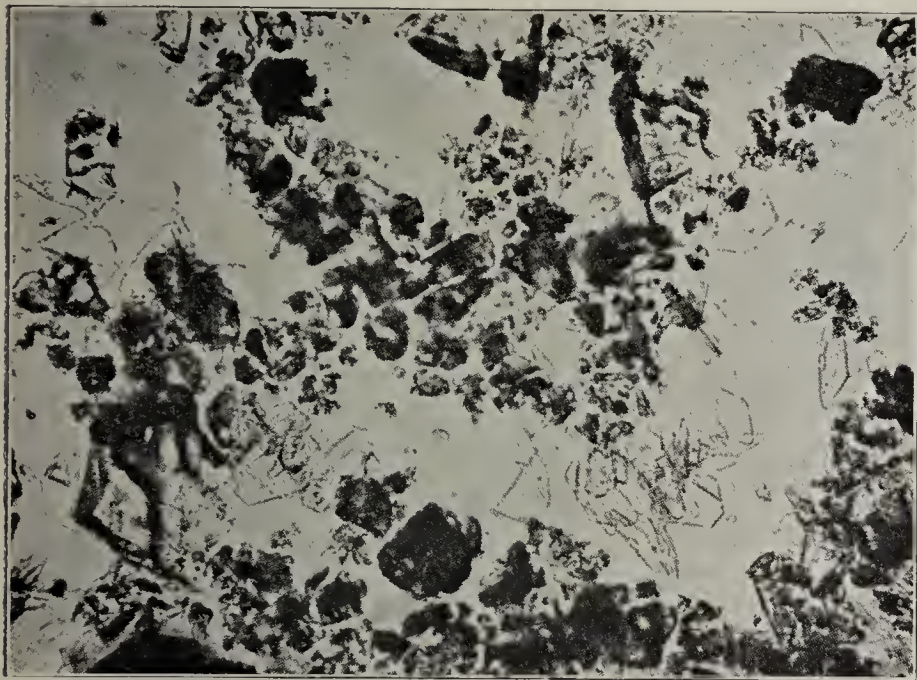
tions the same as Portland cement brought it on the market as a strong competitor of the latter. Blast furnace slag obtains hydraulic properties if it is chilled quickly by pouring the molten slag in cold water or by letting it drop on a cooled iron plate. These two methods result in either water-granulated or air-granulated slag cement. All these slag cements have

to be assisted in their hardening by an admixture of Portland cement or calcium hydrate in order to increase the percentage of lime in which these slags are deficient.

Soon after the value of blast furnace slag as a hydraulic cement was established, experts tried to find the composition of the compounds forming in the hardening process.

As the composition of blast furnace slag is very much the same as Portland cement, only lower in lime, it was expected to yield the same compounds of hydration as the latter.

The setting and hardening of slag cements was studied in the same way as in the case of Portland cement. After a short observation of several hours it became noticeable that the preparations of slag cement hydrated faster and that the needle-crystals as well as the plate-crystals developed more fully, so that they represented the pictures shown on cuts 8 and 9 after only three or four days. Slag cements do not contain as many large hexagonal crystals as Portland cement preparations; those that were found to be present disintegrated in time in the same way as

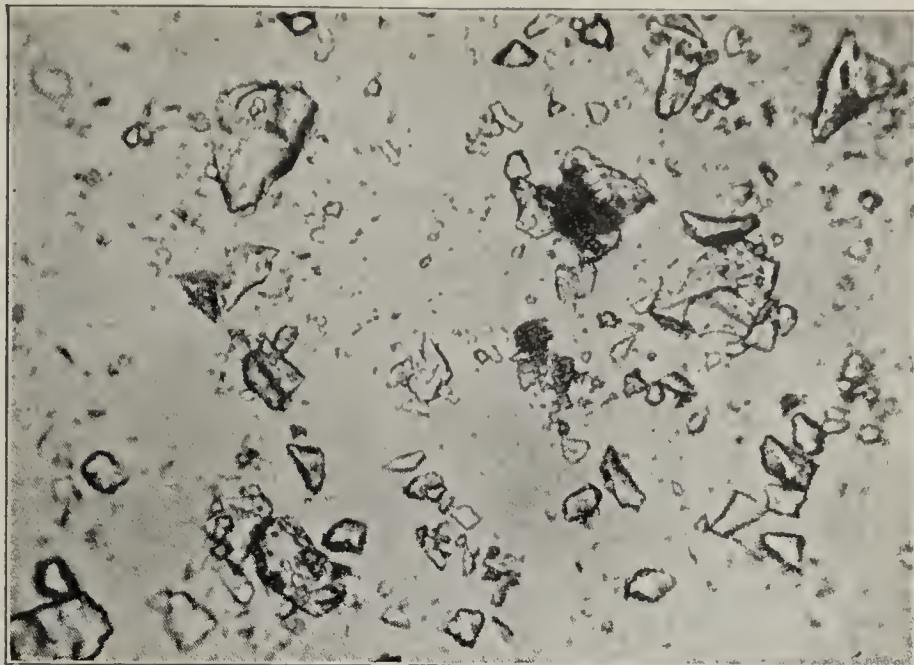


No. 8. Plate Crystals of Calcium Aluminate in Slag Cement After Four Days.

previously observed in Portland cement, but this process of disintegration started earlier with the slag cements. Formation of colloidal bodies proceeded in the same way as with Portland cement. In both instances, therefore, colloids form only after the crystals have developed; this is illustrated on cuts 7 and 8, which show a splendid development of crystals, while not even a trace of colloids is noticeable in this early stage.

The staining solutions reacted upon these slides the same as in the case of Portland cement. Anthra-purpurine stained all products of hydration, patent-blue only the plate-crystals and acetic acid methylene-blue the colloids and also the needle-crystals, slowly dissolving the latter. In addition to these, in almost all preparations clusters of crystals of ferrous silicate could be identified by means of the Berlin-blue reaction. These needle-crystals behaved the same as those of the artificial iron silicate fluxes. As, furthermore, needle and plate-crystals have the same optic properties as the artificially prepared silicate needle-crystals, and calcium aluminate plate-crystals, they must be identical with the latter. Hence, slag cements yield the same products of hydration as Portland cement.

The difference characterizing the two kinds of cements consists in a smaller percentage of calcium hydrate crystals in the case of slag cements and in



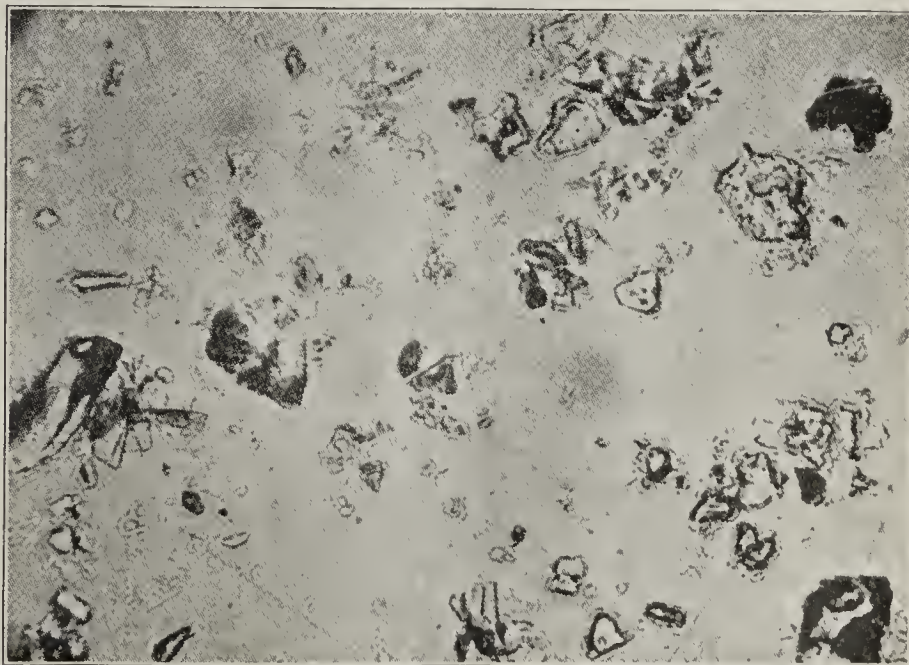
No. 9. Blast Furnace Slag, Air-Granulated After Three Months. The Slag Has Not Been Affected by the Water.

the fact that with the latter cements the iron compounds take a part in the hardening, though only to a limited extent, through formation of needle-crystals of ferrous silicate.

Summary: The outcome of the preceding research work is that the hydration of cement must be divided into two phases, the setting and the hardening process. The methods described in the foregoing made it possible for the first time to follow these two separate processes through their various stages of development. In every instance, the hydration began with the formation of crystals of calcium silicate and tri-calcium aluminate. Only later, after the crystals had fully developed, a colloidal mass began to form, consisting of calcium silicate.

This proves that the setting of cement is brought about mainly by crystallization. The silicate and aluminate crystals develop very quickly. As formerly stated, the growing of the aluminate crystals from a fused mixture of tri-calcium aluminate could even be observed under the microscope. The needle and plate-crystals protruding from the adjoining grains of clinker interlace intimately and thus make the particles of cement adhere one to another.

The tri-calcium aluminate takes an important part in this setting process. Kaisermann thought that the only object of the aluminate was the lowering of the point of vitrification of the clinker and the acceleration of the formation of the calcium silicate during the



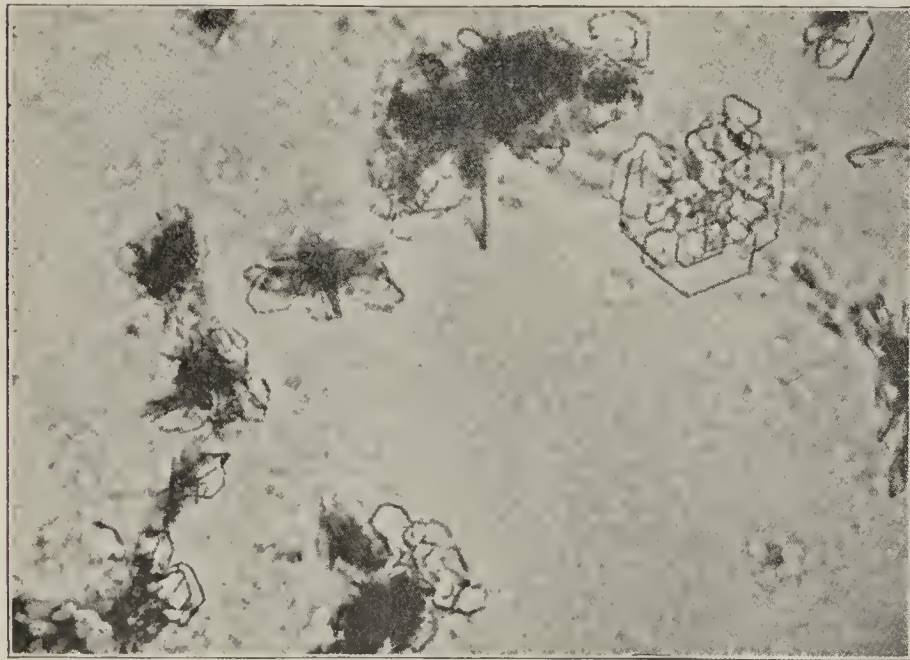
No. 10. The Same Slag as in Cut 9 After Having Been Treated with a 5% Alkali Solution Which Promoted the Development of Colloids and Plate and Needle Crystals.

process of hydration. According to Schott, the tri-calcium aluminate did not set at all. This, however, is contradicted by the observation made on the tri-calcium aluminate flux which set admirably so that the tri-calcium aluminate must even be considered the main factor in the setting process, as it was seen always to form at first in all cements.

But only with the formation of colloidal bodies does the hardening process really begin. This sets in only after almost complete development of the crystals. The colloids cement the crystals and undecomposed grains of clinker together and fill out all interstices.

The formation of crystals of calcium hydrate does not seem to have any direct bearing upon the hardening process. They form only if the cement contains a large surplus of lime and represent, so to speak, a storage of basic material, which, upon admission of enough water, is able to convert more and more of the clinker into colloids, thus further increasing the strength of the hardening cement. In preparations several weeks old the observation was made that the crystals of calcium hydrate showed fissures and finally dissolved at the expense of newly formed colloids, a proof that they take the part of contributing to the formation of ever-increasing quantities of colloids. Part of the calcium hydrate, especially if near the surface, is converted into carbonate of lime. The calcium hydrate in the interior, however, is so well surrounded by colloids and protected by them from the atmosphere, that formation of calcium carbonate cannot be considered an essential factor in the hardening.

Formation of crystals as well as of colloids in cements is possible only if the cement contains a surplus of lime. Mere hydration of the calcium silicate compounds, formed in the process of calcination, does not take place. A proof of this is the behavior of blast furnace slags, which are able to hydrate only with an admixture of calcium hydrate or alkalies. Furthermore, the formation of tri-calcium aluminate in hydrating cement is not necessarily due to the presence of

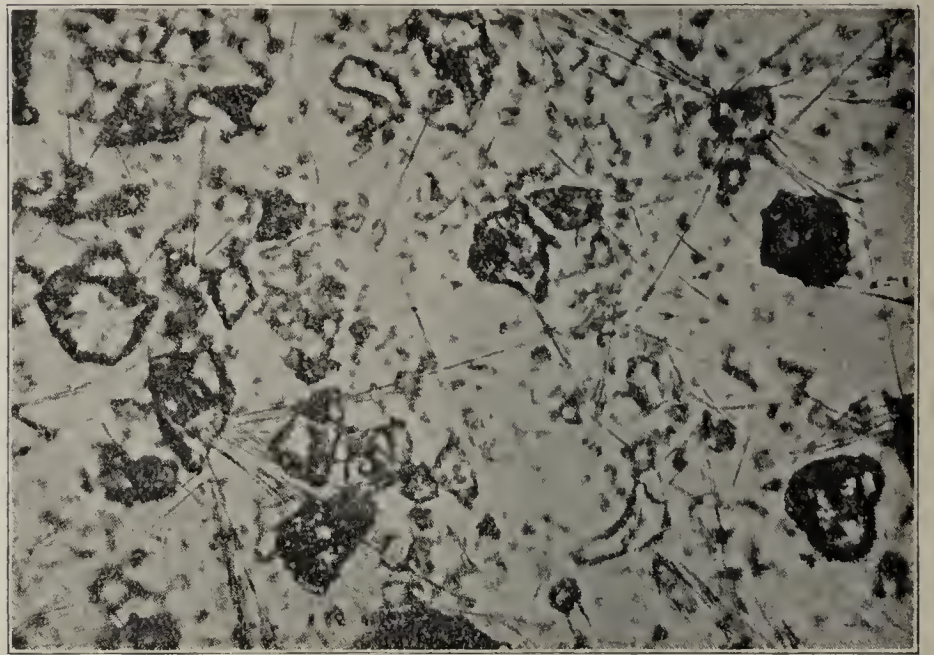


No. 11. The Same Slag as in Cuts 9 and 10 After Having Been Acted Upon by Lime Water for Three Months. The Slag Has Been Completely Decomposed Under Formation of Especially Calcium Aluminate Plate Crystals.

this compound in the calcined product, for it is obtained just as well if a mixture of lime and clay is burnt for some time at red heat without reaching the point of vitrification; in this case, therefore, no compound is formed, but lime and clay are merely put in a position to act upon each other in the presence of water.

The foregoing research work leads to the conclusion that in the course of the process of hydration of the various hydraulic cements the same products are formed, namely:

1. Small hexagonal plate-crystals composed of tri-calcium aluminate.
2. Fine needle-crystals of mono-calcium silicate.
3. A colloidal mass of mono-calcium silicate.



No. 12. Blast-Furnace Slag, Water-Granulated, After Three Months. The Fine Needle Crystals Are Calcium Silicate.

4. Large hexagonal crystals of calcium hydrate. These, however, contribute only indirectly to the hardening.

Iron may take a part in the process of hydration by forming with silica ferrous silicate or with alumina tri-calcium ferrite.

The products of hydration are not merely hydrated compounds already existing in the calcined product, but are formed after previous decomposition of the compounds of the clinker under the influence of water.

The setting of the cement is a process of crystallization brought about by the formation of plate crystals of tri-calcium aluminate and needle-crystals of mono-calcium silicate.

The hardening process is due to the formation of a colloidal mass consisting of mono-calcium silicate, which cements the crystals. These colloids continue to form as long as calcium oxide, soluble silica and water are available.

CANADA CEMENT COMPANY BUILDS EXPERIMENTAL ROAD

An experimental concrete road, consisting of 15 sections built in different ways, has been constructed at the Montreal plant of the Canada Cement Company. All sections of the road are 20 feet wide—concrete 14 feet and shoulders 3 feet. The proportions used for one-course concrete were 1:1½:3. For two-course concrete the proportions for the base were 1:2½:5 and for the wearing course 1:1:1½. The concrete is 6 inches thick at the sides and 8 inches thick at the center for all sections. In two-course sections the wearing course has a uniform thickness of 2 inches.

In some sections 8 lb. of high calcium hydrated lime were added to each bag of cement and the two thoroughly mixed before placing in the concrete mixer. In the one-course sections containing lime, the lime was used throughout the entire thickness, but in two-course sections the lime was used in the top course only.

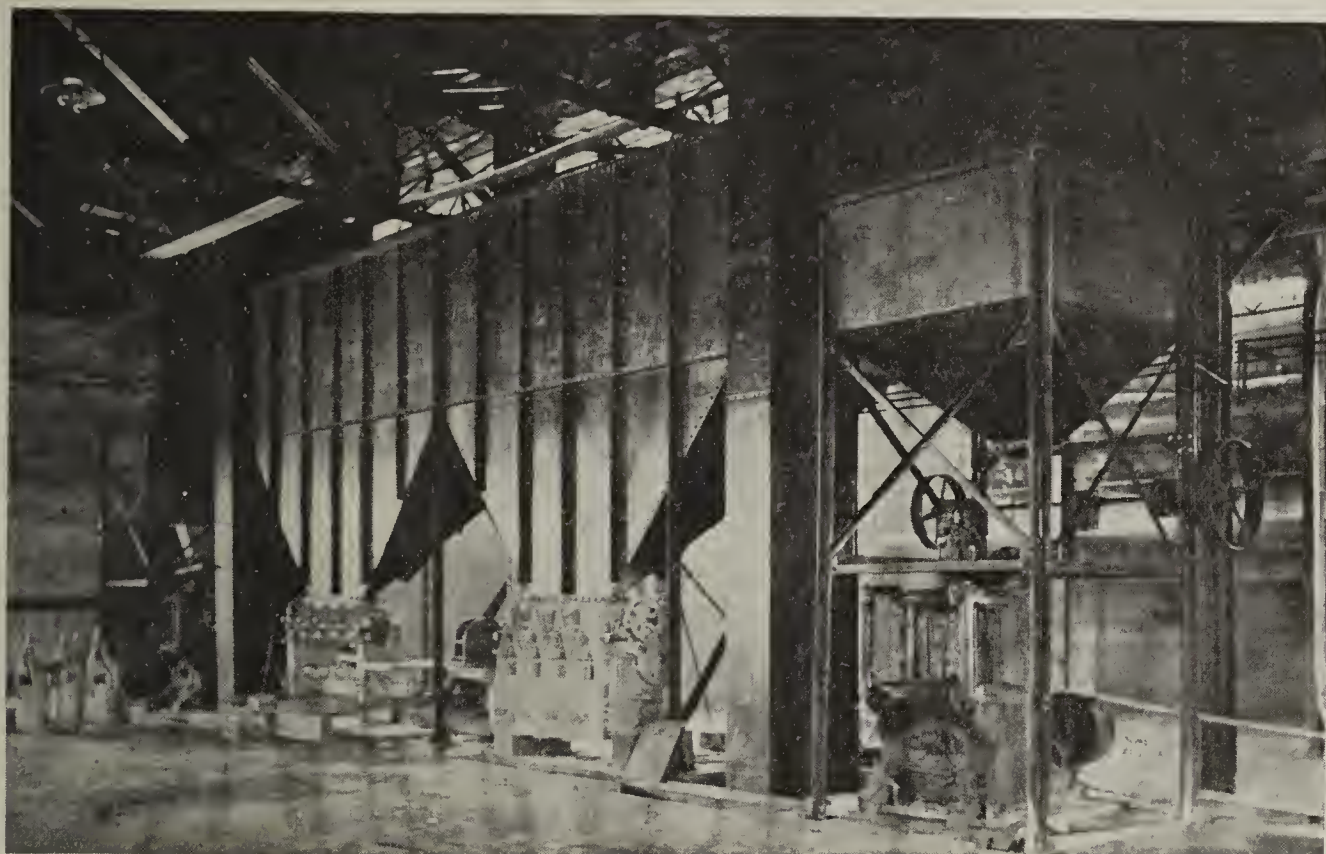
National Mortar & Supply Co.'s Plant.

For ten years the advancement made in the lime industry, especially toward the development of the large consumption of hydrated lime, has been its most progressive effort, and to no factor in the industry can we attribute more of this progress than to A. H. Lauman, who is president and general manager of the National Mortar & Supply Co., Pittsburgh, Pa., with plants located at Gibsonburg, Ohio. The product of this plant is particularly adaptable for making dry lime putty and the result is, the hydrated lime of this section is well and favorably known. The large production of the various plants in this county alone exemplifies the possibilities of the product, when once introduced.

The progress of the National Mortar & Supply Company's operations has been due to the quality of the material and the engineering and practical experience of Mr. Lauman who, after selecting stone, puts it in such form and handles it with a mechanical ability

blocks with steel framing and floors of cement. The new building contains 36,000 square feet. One tramway will convey the raw material to the top of the kilns, which will be operated by electricity. The boiler rooms are separate and of the most modern type. Three cars of coal on track between the plant and boiler room can be unloaded at one time. Overhead bunkers are used for carrying some 100 tons over the producers and boilers for the quick handling of fuel. All coal is handled by machinery. Water softening and purifying equipment is used for water feed to the boilers and necessary modern equipment belonging to an up-to-date outfit. One man to unload or dump coal from cars is all that is necessary for this manipulation.

The raw material supplies of this company compose 230 acres of quarry land owned by them for some years, and during that period they only made a hole about 35 feet deep and about two blocks in circum-



Shipping Bins and Packing Machines, from Warehouse Floor.

not excelled by any other operator in the lime trade. Following the rapid growth of this institution President Lauman for a year or more has been working out new developments, and the result of his efforts is today a new plant; and to the end of seeing what they have done the writer spent a day at this institution and others in that county. It was an interesting trip to go through the three plants of the company, starting with the old operations which are fully described later in this article.

This new plant of the National Mortar & Supply Co., at Gibsonburg, Ohio, when put in operation very soon, will give that company an equipment of some 35 kilns; the new plant itself containing 15 cement-constructed, newest type kilns, operated by three Bradley gas producers; one Westinghouse turbine of 500 kilowatts; Sterling water tube superheated boilers; grinding machinery and air separation. A special slaker of Mr. Lauman's own patent will be in operation; conveyor 150 feet long will convey the lump lime to the grinder; the ground material will then be taken from the slaker to the pulverizers with a screw conveyor. A Bates valve bag equipment will sack the lime. The buildings are of high-grade cement construction with roof of book tile, walls of cement

ference; thus you will see that the increased production will make little impress on the raw material.

The construction of this plant is along the ideas worked out by Mr. Lauman and he has been ably assisted in putting it together and equipping it by his superintendent, F. J. Westelewski, who makes his home, which is of modern construction, owned by the company and in close reach of the plant, right on the company's own land. Young August Lauman, a graduate of Cornell, is also an able assistant. It is one of the best constructed plants the writer has ever seen in any line, and its product will be as good, if not excel, the "Banner" lime produced by the old plants.

The officers of this company, which was organized at Pittsburgh a number of years ago, are: A. H. Lauman, president; Alexander Gilliland, vice-president; C. H. Stolzenbach, secretary-treasurer, he also being secretary of the Iron City Sand Co., of Pittsburgh. Two of the young men assisting in the handling of this business at Gibsonburg are Harold R. Zorn and William Long.

These operations are located on the outskirts of the town of Gibsonburg, Ohio. It is near the center of the rich limestone belt frequently referred to as the Toledo district. The property is connected with the



Looking Across the Quarry at the National Mortar & Supply Co's Plants.

main line of the Toledo division of the Pennsylvania railroad by a spur track half-a-mile long. This runs alongside the loading doors for outgoing shipments; also to the rock crusher storage for gravity loading. A branch from the main spur half a mile long reaches the coal pockets outside the plant where are located the boiler houses and gas producers. The old plant is constructed of heavy structural material and built upon massive concrete foundations, which rest upon bedrock. The boiler power houses, kiln houses, including the drawing floors, are built of hollow concrete blocks made on the job for the purpose.

The original hydrate mill building is of the best wooden mill construction; fire floor is of iron and brick construction. The plants are driven by steam power generated by 300 h. p. boilers which are embedded in brick concrete and draft is induced by a single stack which stands upon a massive concrete pier 120 feet in the clear without a guy line or support of any kind.

The engine room adjoins the boiler house. Here an automatic Corliss engine, 180 h. p., drives the main shaft of the entire works by means of a 22-inch belt. The floor of the engine room is of brick. A Bury air compressor (345 per minute) furnishes air needed to run the quarry equipment and the dynamos in the power department; also makes current for lighting every part of the works. The quarry is equipped with industrial two-yard side-dump cars, both air and steam drills, besides plenty of tools of modern manufacture.

A Clipper drill, manufactured by the Loomis Machine Co., Tiffin, Ohio, is kept busy driving holes for blasting. Cars are loaded with rock at the working face and taken to the top of the kilns by cable incline and discharged by side-dump cars and returned by gravity to the quarry floor. Between the quarry and lime kiln is located a well appointed rock crushing plant (immediately beneath the incline that carries rock to the kilns). This is one of the products of the plant, broken rock being sold to road contractors, to public officials for street improvement, and for concrete work. A No. 5 McCully crusher with suitable elevators and separating screens does the work of this department. The storage bins have a capacity of 400 tons and four separations are made as is usual in Ohio road requirements at the present time. The bins are erected upon solid concrete foundation of sufficient elevation to provide for loading the cars by spouting the material direct by gravity. A 40-horse power motor operates the crusher plant. The 20 kilns in the first two plants are in batteries of 10. They are all steel, lined in the usual way with fire brick, and 37 feet high from the floor to the top. Six feet over the top of the kilns is a wrought-iron cribbing extending 16 inches inside over all. Into this the stone is dumped from the quarry cars, the hoist and dumping of the cars being taken care of by one man. Here a large amount of stone can be stored, and as it lies there before being put into the kiln it receives the benefit of the heat in drying.

The burning is done by Bradley gas producers, installed by the Duff Patents Co., of Pittsburgh. This process has been successful in glass and steel plants and has proved itself in these operations. For the 20-odd kilns of this company, four producers supply the full battery. Coal used is mostly from the Ohio and Pennsylvania bituminous districts. On the firing floor coal is dumped into a hopper and fed to the producer. The oval shaped retort is nine feet long, eight feet wide and twelve feet deep. Below the grade in the producer is a layer of ashes submerged in water to prevent air entering from below.

On either side of the producer are two sets of pipes.

four in all, through which steam is injected at a pressure of 45 pounds. The steam carries the required amount of air necessary to create the gas. The gas passes into brick-lined steel flues, 110 feet long and 48 inches in diameter, running the entire length of the battery and kilns on both sides. In making the first fire in the kiln about a car of wood is piled in the fire arch and the kiln is filled with rock; about the time the wood is burned out the limestone has become red hot. The gas and air are then turned on, the proper amount of each being governed by valves and determined by the color of the flame. At its best the flame is between 1,500 and 1,800 degrees centigrade. The natural draft created carries the flame about eight inches above the fire arch, depending, of course, largely on the size of the stone and the way it is packed into the kiln. It requires a shift of two men to run the fire operations and drawings of the kilns are made every three or four hours. The full con-

man, whose successful engineering ability first introduced hydrated lime on a commercial basis. The hydrating machines, of which there are two, consist of 30 feet cylinders 48 inches in diameter. These cylinders are stationary and the mass of contained material is agitated by the action of paddles. The hydrators are in a level position, and the mass pushes through the machine while a stream of water is played on it, the process being continuous. The capacity of each hydrator is four tons per hour. The hydrate is again elevated to the third floor through an open spiral conveyor 150 feet in length, this being the cooling process. From this conveyor it is spouted into two Raymond Brothers Impact Pulverizers, one for each hydrator. These machines are operated continuously, the current of circulating air drawing the finest particles of the hydrate up into the storage bins. The coarser particles are dropped back into the pulverizer, after which they are again put through the same



Kilns, Cooling Floors, Gas Producers and Hydrating Equipment.

sumption in burning lime will average about five pounds of lime to one pound of coal.

The operation of the basket below the kiln is governed by a lever from the firing floor. The lime is dropped into steel cars and distributed over the brick cooling floor, 125x125 feet in size. The lime floor is shut off from the hydrating mill and warehouse by a concrete curtain wall, but connected by a galvanized iron fire door.

The first floor of the warehouse, which is the shipping floor also, is 135x128 feet. Lime is brought into the mill on wheelbarrows and put through a Sturtevant crusher. From this it is spouted into a steel-incased Jeffrey elevator and raised 48 feet to the third floor. Here, in a 50,000-pound capacity bin, the crushed lime is kept. From this bin the lime is spouted into a grinder, and from there is dropped into another bucket elevator which conveys it up 35 feet. The pulverized lime then passes over a fine screen for glass house lime, the tailings being spouted back to the pulverizer and put through again. After passing the screen the lime drops into a bin of 20-ton capacity, and from there into a bagger. It is now ready for the ground lime trade, which is a rapidly growing branch of the industry.

The hydrating plant is operated under the Lauman process, the handiwork and invention of A. H. Lau-

man, whose successful engineering ability first introduced hydrated lime on a commercial basis. Each of the two bins has a capacity of twenty-five tons of uniformly separated hydrate.

In this whole process of hydrating not a human hand touches the lime from the time it is dropped into the crusher until the bags are removed from the bagging machines. It is entirely automatic.

The hydrate manufactured at this plant is well known to the trade in all parts of the country as a fine specimen of the famous Ohio type of magnesian lime, perfectly hydrated. Its market name is "Banner" Hydrate Lime, and with the exception of that part sold in the shape of ground lime the entire output of the 35 kilns will be made into hydrate.

The growth of the demand for hydrate in the past year or two proves that the improved method of marketing lime is a success, one that will continue to grow and be a benefit to the producer, the retailer, the contractor, and last but not least, by any means, the consumer, who gets a better job and is satisfied thereby. All of this benefit and achievement is in no small measure creditable to the presiding genius who designed and constructed the plants just described, because he first recognized a need for a hydrate and set about producing it with gratifying success, and he allows that it is not necessary to state that such experience costs money.

Reinforced Concrete Poles for San Francisco Municipal Railway

By John S. Martin*

A rapid stride toward permanent construction has been taken by the city of San Francisco in the installation of reinforced concrete trolley poles for the extension to the Municipal Railway Systems. Two hundred and fifty-nine of these poles have been erected on Van Ness avenue, and seven hundred and thirty-six more are being placed along Chestnut street leading to the entrance of the Exposition grounds, along Stockton street, Potrero avenue, and other extensions to the present lines.

Municipal ownership of railways has proved financially successful in San Francisco, and because of the permanent construction used in all branches of the work, the upkeep cost will be light and the profits correspondingly high. Great care is taken in the concrete construction of buildings, reservoirs, poles, etc., and the cement-gun is an important factor in this work. A dense, homogeneous mass of cement mortar is applied to the concrete walls of the buildings, reservoirs, and poles, primarily as a finish, but in reality this cement-gun mortar makes a perfect bond with the concrete, fills in all voids, and gives an absolutely water-tight wall. These results cannot be obtained by other methods.

Before going into detail as to the construction of the trolley poles, it may be interesting to note some of the cement-gun work that has been done for San Francisco. The Mission Viaduct was coated with $\frac{1}{4}$ in. of this so-called 'gunite'; all exterior and interior concrete surfaces of the municipal incinerating plant, including the 152-ft. concrete chimney, were finished by means of the cement-gun process; concrete walls were made water-tight on the 750,000-gal. Jones street tank, the dividing wall of the Twin Peaks reservoir,

31 ft. 8 in. over all, and taper from 2 ft. 4 in. square at the base to 11 in. square at the top. All poles have a $\frac{7}{8}$ -in. chamfer on the four corners.

Rows of wooden forms were built in a level lot secured by the contractor for this work. These forms were constructed of good sound lumber of correct



Fig. 3. Cement Gun Outfit Mounted on Truck.

shape and dimensions, of sufficient strength and so braced that they maintained proper shape and position against the placing and ramming of concrete during the progress of the work. All boards coming in contact with the exposed concrete were sized to a uniform thickness and the edges were jointed so as to make the forms substantially water-tight, with the rough side next to the concrete. All forms were thoroughly braced and tied together so that the pressure of the concrete or the movement of men, machinery, or materials could not throw them out of line, and were so constructed that they could be easily removed without injury to the concrete. Before placing the concrete, the forms were thoroughly cleaned and wet down with a hose and running water. The steel used for reinforcing was $\frac{3}{4}$ in., and $\frac{7}{8}$ -in. bars having net section areas of 0.56 and 0.77 square inch respectively. These were accurately shaped, bent, as-

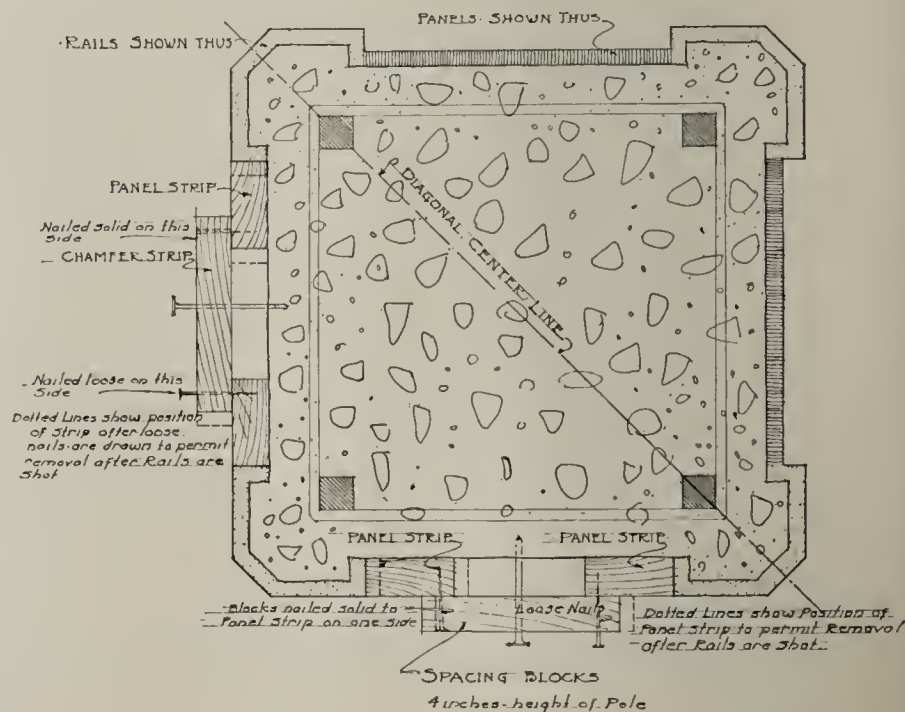


Fig. 2. Poles Curing in Forms.

the foundations of the new City Hall, the Geary street car house, and the water tanks for Pumping Station No. 2. At this station the flues were built of 'gunite' shot to a thickness of 2 in. on Trusset metal, and these have given entire satisfaction for the passage of gases at a temperature of 600° Fahrenheit.

Fig. 1 shows the design of the concrete trolley poles for Van Ness avenue. There are two hundred and thirty-six 'standard' poles which measure 31 ft. 2 in. over all, and taper from 14 in. square at the base to 9½ in. square at the top. In addition to these, there are twenty-three 'strain' poles which measure

*President Martin Cement Gun Co., San Francisco.



sembled, banded together, and placed in the forms as shown in Fig. 1.

'Galvanite' conduits were placed in the poles for lighting and feeder cables. Two hundred and nineteen 'standard' and twenty-one 'strain' poles contain two 1-in. conduits, and seventeen 'standard' and two 'strain' poles contain two 1-in. and one 1½-in. conduits, all placed as shown. The concrete used was composed of portland cement, sand, and broken rock, in the proportions of 1 cu. ft. of cement, 2 cu. ft. of sand, and 4 cu. ft. of broken rock. This concrete was mixed by a machine, poured into the forms, and thoroughly tamped. No greater quantity of concrete was prepared than was required for immediate use. All fresh concrete was protected from the weather by a wet sand topping, and was thoroughly wet down twice daily for seven days after placing. Fig. 2 shows some of the forms into which the concrete had been poured. The forms were removed not sooner than thirty days after pouring, and were cleaned before using a second time. Any voids, stone pockets, or other imperfections were satisfactorily repaired by the cement-gun while the poles were being finished.

When the forms had been carefully removed, the poles were hauled up the avenue and were lowered into the ground by means of a portable derrick. The 'standard' poles were set in the ground to a depth of 6 ft. 6 in., and the 'strain' poles were set to a depth of 7 ft. below the level of the sidewalk. The base of each pole was surrounded by 6 in. of concrete. Cast iron bases and finials were then set in place, by use of the portable derrick, and galvanized steel bolts were securely fastened in place as shown.

After the poles were erected and the finials and bases were properly set, all concrete surfaces were finished with cement mortar in accordance with the following typical specifications for gunite:

Cement Finish on Concrete

All exposed concrete surfaces of the poles shall be finished with one coat of cement mortar applied by means of a Cement Gun.

Portland Cement Finish.—All the exposed concrete surfaces shall be prepared by removing all loose material adhering thereto and by thoroughly washing with water, after which they shall be finished with cement mortar composed of 1 part Portland cement, 1 part Keystone sand, and 2 parts bank sand, applied by means of a cement gun. This mortar shall be of sufficient thickness to conceal all form marks and other imperfections.

All work shall be 'rodged' in the most careful manner. All molded courses shall be accurately run in accordance with the details shown. All arises shall be clearly defined, true and sharp. All surfaces shall be practically true planes, uniform, straight and plumb, complete in every respect. The color of the finish when dry must be uniform throughout free from spots and discolorations. If necessary, all arises must be stripped in order to be clearly defined, true and sharp.

It is rather interesting to note the above rigid specifications for cement-gun-applied mortar, or 'gunite', since there has been considerable discussion as to the ability of the cement-gun men to obtain plane surfaces the sharp true angles and arises. It may be well to state here that the many advantages of gunite lie entirely in the method of application, and when once applied, cement-gun mortar is rodged up, floated, stripped, or gun-sprayed to suit any requirements for finish.

The concrete poles along Van Ness avenue were spaced four to the block on either side of the street from Market street to Bay Point, a total distance of thirty-two blocks, or two miles. From this layout it can readily be seen that it became necessary to change from the usual cement-gun equipment. This consists of a 'gun' with its hoze, nozzle, etc., and a portable

gas engine or motor-driven compressor capable of furnishing 135 cu. ft. of free air per minute at a pressure of 40 lb. per square inch. Such an outfit is entirely satisfactory for most work, as one or two set-ups are sufficient to do an entire job. However, with the poles, it was a case of shift from pole to pole, and each shift meant moving the gun, compressor, materials, and scaffold.

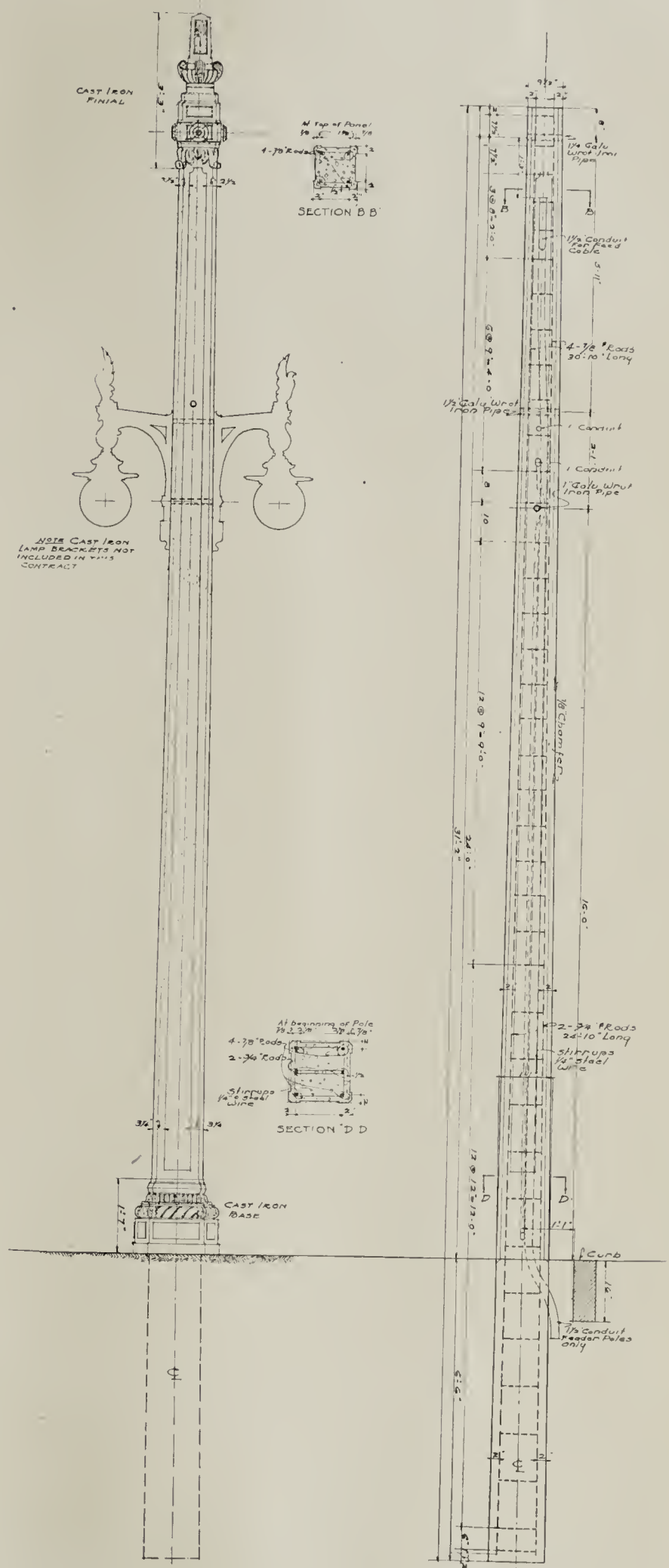


Fig. 1. Elevation of Reinforced Concrete Trolley Poles Showing Reinforcement.

Fig. 3 shows one of the two outfits that were rigged especially for this job. A gas engine-driven compressor was mounted on the forward end of a large dray and securely bolted in place. The gun was placed just back

of the compressor and securely fastened down, and the necessary hose connections were made between the two machines. Water was carried in two 110-gal. drums placed on either side of the outfit, and by means of a small air-driven Worthington pump was circulated through the compressor and through the nozzle line. A small material box was built in the end of this outfit, and then with the aid of a team of horses, the compressor, gun, hose, nozzle, water, and material were moved in one operation.

Fig. 4 shows a typical cross-section of the concrete poles. The most difficult feature of this work was producing the sunken panel with its sharp, true angles and arises. As can be seen, there are eight angles and sixteen arises on each pole which were brought out in the following manner: A set of collapsible wooden strips were made to fit in the sunken panel. These strips, as shown in Fig. 5, consisted of two strips, *M* and *N*, milled to taper and size, and fastened together by means of a third strip *R* that was securely fastened to *M* and temporarily fastened to strip *N* by means of eight-penny nails. These panel

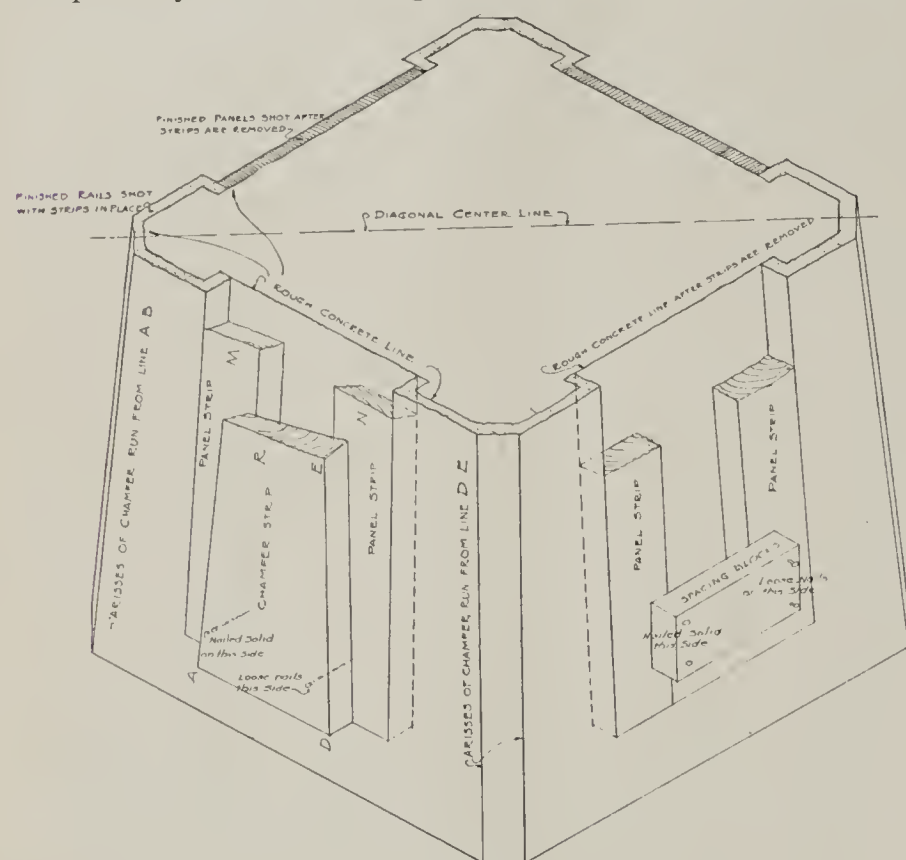


Fig. 5.

strips were put in place and then secured by means of so-called 'concrete' nails, which are 2-in. galvanized roofing nails.

The gun outfit was then brought up to the stripped pole and a coating of gunite was applied to the 'rails' or four corners. Fig. 6 shows the nozzleman performing this operation. By means of a template cut to fit the rail and to ride on the panel strips as shown in Fig. 5 and 7, the next operation was greatly simplified. When this template was drawn over the gunite from the top to the bottom of the pole, the four arises on each rail were cut true and sharp in one operation. The man following behind the template touched up the work and floated it to a smooth surface.

These rails were permitted to set over night, and the next morning, while additional poles were being 'shot,' the nails were pulled from strip *R* on the strip-*N* side, and the panel strips were thus easily removed. In this way the two angles of each corner were left true and sharp, and no additional work was necessary as this left the angles and arises complete in every respect. After the panel strips were removed, the outfit was hauled back to the pole and the panels were shot and floated, as shown in Fig. 8. A small amount of detail work was necessary under the final

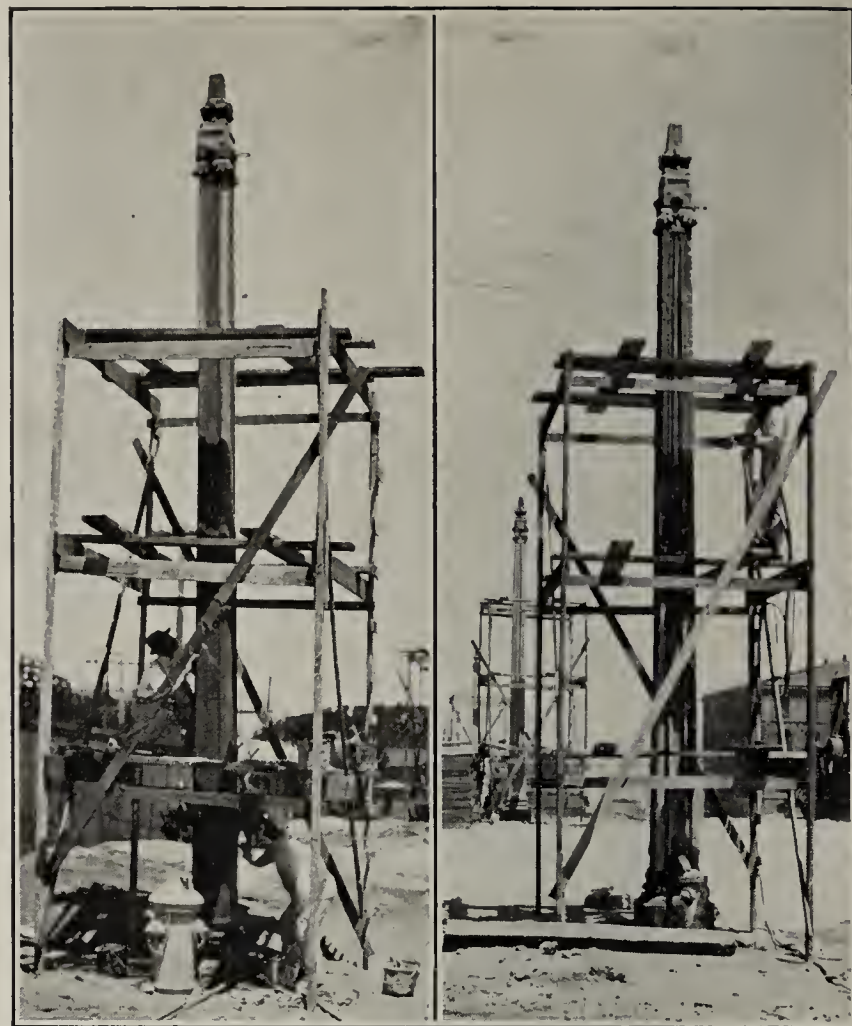


Fig. 8.

Fig. 6.

and base, and when this was done the pole was completed and the staging was shifted to another pole. The staging was built in two sections and was thus easily assembled and torn down to move from pole to pole. A canvas curtain was hung on the staging as a preventive against public injuries that might have been caused by the flying sand. High winds caused excessive blowing away of the material as it was shot from the nozzle.

Each pole required only 9 cu. ft. of mixed material, and because of the constant shifting it was necessary to scatter the material out over the job at intervals



Fig. 7.

of four blocks. From these stations the hod-carriers wheeled the material to the box on the outfit. Another hod-carrier stayed with the 'gun' to load the material into the hopper and to move the hose and nozzle.

There were two 'gun' outfits employed in this work, each having a crew of four men, the nozzleman, hod-carrier, engineer, and teamster. The operation of shooting the 'rail' required about 20 minutes, and shooting the panels took about 11 minutes. The 'follow-up' crew consisted of sixteen plasterers and two foremen, and this crew finished sixteen poles per day. Two men finished the 'rails' in one pole in 2 hours and 15 minutes, and the panel in 1 hour and 45 minutes. In this way, the average was a pole to the man per day.

After the gunite had been kept thoroughly wet down for one week, each pole was painted with two coats of 'Concreto' cement paint, and the bases and finials received three coats of lead and oil. The color chosen was a cream yellow, and the general effect is very pleasing.

Cost Data*

Average cost per pole including contractor's profit.	
Forms, including labor	\$12.00
Reinforcing steel, including labor	18.00
Conduits, in place	6.50
Concrete, in place	10.50
Cast iron bases and finials and eye-bolts, in place....	25.00
Erecting, back-fill, repairs to sidewalk	22.00
Hauling	3.00
Painting	3.50
Cleaning streets	1.50
Scaffold material	0.48
Scaffold labor	1.56
Cement (for gunite)	2.16
Sand (for gunite)	0.46
Water (for gunite)	0.10
Mixing labor	1.50
Panel strips	0.40
Labor and teams for shooting	8.66
Labor of 'follow-up' crew	9.20
Cleaning street	0.50
Gasoline, oil, supplies	0.50
Hose	0.48

Total cost per pole\$128.00
 Cost of 'Gunite' per pole\$26.00

*Cost data furnished by H. S. Tittle, general contractor.

OBSTITCH DIAMOND REINFORCED BELTS

In power transmitting, elevating and conveying Obstitch diamond reinforced belts and Mount Vernon belts stand for "making good." What interests you in buying a belt is to know what it will do—judged, of course, by what it has done and is doing. That is precisely where Obstitch and Mount Vernon belts are strong—in service.

At the same time, we believe you will be glad to know something of the making of these belts, and of the quality of materials and workmanship that goes into them.

Our factory in Baltimore is especially constructed for the maximum of convenience and comfort, as well as efficiency.

As to the actual manufacture of Obstitch and Mount Vernon belts, the first thing to be considered is the canvas of which they are made.

The canvas makers of this country give us the reputation of being the hardest belt makers in the business to suit. They are all very civil about it, but as their opinion seems to be unanimous, we suppose they must be right. This reputation, however, has been established with no desire simply to be odd.

There have been so many utterly foolish claims made, as to weight and quality of canvas, and quality

of oils, used in belts, often reinforced by samples (?) of these materials, the absurdity, not to use a stronger word, of which must be apparent to the buyer on a little thought, that we ask pardon if we seem blunt, or even brusque in what we say.

The canvas we use in our belts is made expressly for us according to our own formula. After it is received by us, it is subjected to specific tests, both in warp and filler, and samples taken at random from each shipment to us are tested by us for tensile strength. Unless the canvas comes up to the specifications in uniform construction, weight and tests, it is summarily rejected.

Weight of canvas! There has been more emphasis laid on the question of weight and more hocus pocus claims based on it than on almost anything else in the make-up of canvas belting. We don't know which sounds the more solemn, "thirty-two-ounce duck" or "syrup of figs." The latter has about as much real relation to belting service as the former.

Moreover, if there is anything that can be "weighted" to a larger extent than belting canvas, we have yet to learn what it is.

We use in Obstitch diamond reinforced belts and in Mount Vernon belts the canvas that careful and exhaustive testing shows us is the best suited for actual running conditions. Our canvas averages more than 33 ounces. This we cite merely as a fact, and not as a quality.

Before it is stored, under conditions insuring it against the absorption of moisture, the canvas is carefully and competently inspected. It is kept dry, so that in the subsequent process it will absorb all of the compound that it should. In other words, canvas can absorb only a certain amount of liquid, and if canvas is loaded with moisture or other weighting materials, the quantity of the compound absorbed will be lessened.

The work of folding the canvas in the making of belts of various plies is done mainly by hand, for the reason that we can do it better that way than with any of the machines thus far brought to our notice. This folding is done under careful and thorough inspection.

Next comes the sewing, and this is done on machines kept up to the minute in efficiency. We have machines which sew belts of any width up to 102 inches, and any thickness up to one inch. We merely mention these to show extremes, but more to the point is the fact that our manufacturing capacity is three times greater than three years ago, because it has to be.

Then the belt is ready for the treating which gives it the wearing and service qualities which have made the reputation of Obstitch and also Mount Vernon.

Remember, that each individual belt is rigidly inspected at certain definite stages in this manufacture, writes the Mt. Vernon Belting Company, 327 Warren avenue, Baltimore, Md.

FREIGHT RATES ON SAND

Sand is sand, whether it be used for glass, molding purposes or for building. This was the conclusion reached by the Ohio public utilities commission the other day when it ordered the Erie Railway Company to cease charging freight rates of 60 cents per ton for hauling glass and moulding sand, and 30 cents per ton for carrying building sand and gravel. The same rate for both must be charged, the commission says, unless particular equipment is demanded by the shipper. In this case an increase of 15 per cent is allowed over the 30-cent rate.

The complaint of excessive charge was made by the Summit Silica Sand Company on shipments from Barberton to Akron.

Cement Drain Tile

Editor The Clay-Worker.

We are enclosing copies of letters from parties who purchased cement drain tile and used it in their drainage systems. As you will see, they find in less than two years that the cement tile have disintegrated and fallen down, completely blocking their ditches. These parties have dug up the cement tile and are preparing to replace it with burned clay drain tile.

We have the original letters from which these copies are made on file in our office at Salem, Ore., and Mr. Wilson, of this firm, was personally on the ground, saw the cement tile as they were out of the ground, and brought four pieces of the 4-inch and one piece of the 6-inch to the office with him.

The pieces of 4-inch cement tile are so badly disintegrated that they can be easily crumbled to pieces with bare fingers and, while the 6-inch cement tile was never in the ground, it shows marked signs of disintegrating, though not as bad as the 4-inch, and can be crumbled with fingers, though not quite as easily as the 4-inch.

It has been only in the last few years that tile drainage has been carried on extensively in the Willamette Valley and the cement tile people have been operating only about three or four years, this being the first actual instance of complete disintegration that we have been able to get reliable data on.

SALEM TILE & MERCANTILE CO.,

Salem, Oregon.

This is to certify that on or about October 1, 1912, I, the undersigned, purchased from the Cresswell Feed & Seed Co., cement drain tile amounting to approximately 150 feet and used the same in installing a drainage system on my farm near Cresswell, Oregon, and that at the present time the cement tile have disintegrated and fallen down and that it will be necessary for me to replace them with burned clay drain tile.

(Signed) J. WULLSCHLEGER.

Cresswell, Oregon, June 15, 1914.

My experience with cement drain tile has been very unsatisfactory and I cannot recommend them to anyone for drainage purposes.

On or about October 1, 1912, I purchased at considerable expense, approximately 1,400 feet of cement drain tile and used it in installing a drainage system on my farm near Saginaw, Ore.

At the present time I find that the cement tile are disintegrating and falling down and that I have to dig out the cement tile and replace it with burned clay drain tile.

(Signed) J. T. OLSON.

Saginaw, Ore.

The above was taken from the July issue of The Clay Worker, a monthly journal devoted to the clay interests. Cement and Engineering News wrote the above mentioned parties and also the manufacturer of the cement tile mentioned. The replies plainly set forth that the cement tile was not properly made—the natural result of which is cement tile that will disintegrate and fall down. Here are the replies:—

Saginaw, Ore., Aug. 9, 1914.

Cement & Engineering News, Chicago, Ill.

Dear Sirs:—Yours of the 5th inst. received, in regard to drainage tile; will say the tile I bought of

Cresswell Feed & Seed Co., at Cresswell, Oregon, came from the Eugene Cement Works, W. C. Hall, proprietor, at Eugene, Ore.

This tile was placed in the soil in Sept., 1912, and this last winter I had to replace 55 feet that was so badly disintegrated I could pick them to pieces with my fingers, not only one, but all that I took up. I replaced with clay tile and unless the Eugene Cement Works put more cement in their tile I wouldn't want them replaced. I wouldn't put them in the ground for them, as far as refunding my money I don't suppose they would do that. What tile I have had to dig up was replaced by Cresswell Feed & Seed Co. with clay tile free of charge. I really think the cement tile is all right if there is enough cement in them.

Thanking you I am yours truly,

J. T. Olson.

Cresswell, Oregon, Aug. 11, 1914.

Cement & Engineering News, Chicago, Ill.

Dear Sirs:—You will please pardon our delay in answering your letter of 8-5-14, but I neglected to open it till now. Regarding the tile we sold Mr. Wullschleger, will say that I know nothing about the making of the tile as we bought them of the Eugene Cement Works, Eugene, Oregon, (W. C. Hall, prop.)

We have had complaints from other of our customers also so we are selling practically no cement tile any more. I think that the car we ordered was shipped to us as soon as it was taken out of the mold as we were filling a rush order at the time. Mr. Hall claims that he has had no other complaint from his tile but something was certainly wrong with the lot he sent us. If we can furnish you any further information, we will be glad to do so.

Yours truly,

CRESSWELL FEED & SEED CO,

Per Harry R. Thompson.

Eugene, Oregon, Sept. 24, 1914.

Cement & Engineering News.

Gentlemen:—The complaint concerning the tile came to me last spring and as I couldn't well give the matter personal investigation, I arranged with the Cresswell Feed and Seed Co. to learn how many tile were defective and I would at once replace them and make good the damage to the parties affected. I am still lacking this information. Will look after the matter at once and if I find the tile are as represented, I shall take great pleasure in making the matter as nearly right as is possible at this time.

My plant is equipped with a large sewer pipe machine, a power drain tile machine, a Helm brick machine, and a Hobbs block machine. These were all installed in the spring of 1912, and have been reasonably busy turning out many miles of sewer pipe and tile, this complaint being the only one made against the products of the factory. During 1912 I furnished many car-loads of 4-inch tile to the street R. R. of this city which is a subsidiary company of the So. Pacific, and had there been any fault to be found with them I certainly should have heard from it.

I have not been on the ground where the tile sold by the Cresswell Feed & Seed Co. were laid, so can't pass upon the charges made. It is a fact that I was rushed with work at the time this car was sold and if the tile were as claimed, I can only account for it in their not being well cured—having too little water

while curing, and being out doors in the sun and wind. I am careful now to keep the tile under cover for 7 days during dry weather as I do my sewer pipe while curing.

I use finely crushed rock in place of sand for all the product of the factory. For tile a 1:4 mixture with plenty of water will produce a tile for strength and utility that the clay people can't equal. At present these are being given a comparative test at the State Agricultural College with the clay tile and I shall be glad to furnish you with the result.

As soon as possible, I will give the entire matter the attention it deserves and will advise you of my conclusions. The clay people are making a hard fight against cement in tile and sewer pipe, but they will finally lose out for they can't make the product. Am very grateful to you for calling my attention to this very important matter. Only wish I had known about it when in Chicago recently.

Very truly yours,
EUGENE CONCRETE WORKS,
By W. C. Hall, Prop.

Cement and Engineering News is inclined to agree with Mr. McCracken, an experienced cement tile manufacturer of Sioux City, Iowa, who states in our February, 1914, issue that: "The right thing for some of the cement tile manufacturers to do is to either get right, or get out of business." Concerning a similar complaint of poorly made cement tile sold by a cement tile manufacturer in Bailey, Mich., Mr. McCracken offered the following advice in our February issue:

"I note with interest what William Passage, of Bailey, Mich., says on page 3 of your January issue, regarding his experience in making cement drain tile. Letters of this kind are just what the clay products paper are looking for, and the chances are this letter of yours will be copied in every one of these papers next month. To an experienced tile manufacturer your letter explains all of your trouble. If you have good clean, sharp sand, which I suppose you have, there are several reasons why your tile are not good, and anyone of these would make your tile absolutely useless.

In the first place you are using a mixture of five to one, and this mixture will not make a good tile even if you had a tile machine that would pack them as hard as it is possible to pack a tile.

"You also say that you sprinkled the tile three times a day. Now, if these tile were made in hot weather, the chances are that you did not keep them thoroughly soaked, and that they had time to turn grey or light colored before they were sprinkled again, and of course after a tile has a chance to dry out enough to be light in color, you had just as well save the water, as it is too late to do it any more good with sprinkling.

"The only way to make good cement tile is to have machinery that will turn you out tile that are perfectly true in shape and packed very dense and hard. Then it is up to you to use a mixture of not less than $3\frac{1}{2}$ to 1, and I find that most of the experienced tile men who have been in the business for the past seven or eight years are using a mixture of 3 to 1, which is really the proper mixture to make first-class tile. This mixture with a good practical tile machine and a good mixer will turn you out tile that will be superior to any clay tile, and of course it is necessary to see that every tile is properly cured, or even with good material and good machinery, your tile would be absolutely worthless. In the first place the mixture you are using would not make good tile under any conditions.

"There are more cement tile factories in Iowa than in any other two states and the cement tile have been winning out over the clay for the past few years, and nearly all of the state and county contracts are going to the cement tile people. This is simply due to the fact that all of these plants are equipped to make first-class tile and make them fast enough to make the business profitable. To give you some idea of what a real cement tile plant is, the Cement Products Company of Spencer, Iowa, uses 400 bags of cement every day, and they make nothing but cement tile.

The thing for you to do is to either get right, or get out of the business. See that your cement tile is properly cured and that it contains sufficient cement.

THE MANUFACTURE OF CEMENT TILE

It has long been recognized that the cement tile manufacturer can resist successfully the attacks on the part of the clay tile producer only by leading an active campaign with a view to educating its members to produce nothing but first-class tile. As long as improperly made and insufficiently cured cement tile were placed on the market, it was evident that the clay tile manufacturer could renew his criticism and point out cases in which cement tile failed. This, of course, would hurt the trade of the manufacturer of high-grade cement tile as well as that of the producer of inferior goods.

A standardization of the methods of manufacture and of testing the finished product was, therefore, decided upon as the first and most important step towards keeping up the reputation which manufacturers of well-made cement tile had established.

All parties interested in the outcome of the work have been busily engaged for some time in contributing their share to the final solution of the problem.

The Portland cement manufacturer, who supplies the most important raw material for making cement tile, put his expert to work to investigate the subject thoroughly. University experiment stations were called upon next in order to act as arbitrators and to test both clay tile and cement tile. The result of their efforts was a number of reports on researches covering every phase of the subject, including proposals for standard methods of making, curing and testing cement tile.

At the same time, the manufacturer of cement tile machinery improved the process of making cement tile so much that a reliable cement tile can easily be obtained, at a fair profit, by any one who works honestly and desires his goods to become a credit to the industry.

Thus, by combined efforts, the cement tile industry bids well to increase rapidly in the same way as all other branches of the cement industry have grown wonderfully from the time standard rules were laid down as a protection against unfair competition and as a safeguard for the purchaser and consumer of the manufactured article.

CONCRETE SEWERS

Reinforced concrete sewers will be built in San Antonio, Texas. The contract has just been awarded for a 72-inch out-flow sewer. Trap rock furnished by the Texas Trap Rock Company, will be used in the construction of this concrete sewer. This company has the only trap rock quarry in Texas, as trap rock is quite rare in Texas. It is of exceptionally high grade, as compared with the trap rock of Eastern states. It has a crushing strength of 30,500 pounds to the square inch. In their crushing plant they operate two Gates crushers and Allis-Chalmers revolving screens which give excellent satisfaction.



The Jackson & Church Company's Plant at Saginaw, Mich.

Don't Sell Machinery Unless Plant Gives Promise of Success

Sand Lime Brick Manufacturers Protected From Inexperienced and Badly Equipped Competition by Jackson-Church Policy

In the years 1900 to 1902, the city of Saginaw, Michigan, was in a transition stage; it had formerly been a one-industry town, relying entirely upon the extensive lumber interests which manufactured billions of feet of lumber from the magnificent white pine forests of the vicinity; with the exhaustion of the timber supply the mills one by one closed down and it became evident to the people of the city that they must engage in other lines of business if their city were not to disappear from the map. New industries of all sorts were encouraged and great success was met with in establishing varied manufacturing plants. One great handicap, however, was met in the failure of the local brick plants to produce a first-class building brick.

At about this time a Saginaw man, whose business required frequent European trips, was struck with the superior quality of sand-lime brick so extensively used in Germany; returning to Saginaw full of enthusiasm for the then new product, he succeeded in arousing a very lively interest in the subject on the part of John L. Jackson and Edgar D. Church of the iron working firm of the Jackson & Church Company. Mr. Jackson immediately started for Germany on a trip of investigation and was so well impressed with the high quality of the product and the comparative simplicity of the method of production that he purchased the American patent rights on processes and machinery and returned to Saginaw, where he and his associates established in 1902 what proved to be the first successful sand-lime brick factory in America, and which has continued its operations profitably to the present time, notwithstanding the growing and vigorous competition of improved clay and shale brick made in and near the city.

The early days of this plant brought many vexing troubles due to the machinery being of more or less defective design and workmanship. Change after change was made and press after press was tried until in 1904 the Jackson & Church Company perfected an improved design of rotary table press which started immediately on a regular run of high quality product day in and day out in moneymaking quantity. This original press is still in use doing as good work as ever and apparently fit for another ten years of steady service.

The successful working of this press and plant led Messrs. Jackson and Church to form a subsidiary company, called the American Sandstone Brick Machinery Company, to build and equip sand-lime brick factories for the customers whom the success of their local brickmaking plant had brought to their doors. This subsidiary company was later absorbed by the parent concern, the Jackson & Church Company, which now handles the business in its own name.

This company has established sand-lime brick plants widely distributed over the United States and Canada, and it is notable that these plants are uniformly successful and prosperous, and this is attributed to the fact that their machinery equipment is of a sort that has been thoroughly tested out and perfected by experienced sand-lime brickmakers, and that the fixed policy of the Jackson & Church Company has been to thoroughly investigate the quality of the raw materials and the nature of the market of all concerns buying machinery from them, and to allow their machinery to be used only in cases where the prospective brick plant would have a reasonable assurance of success. The early days of the industry were marked by a boom in which unscrupulous promoters often unloaded

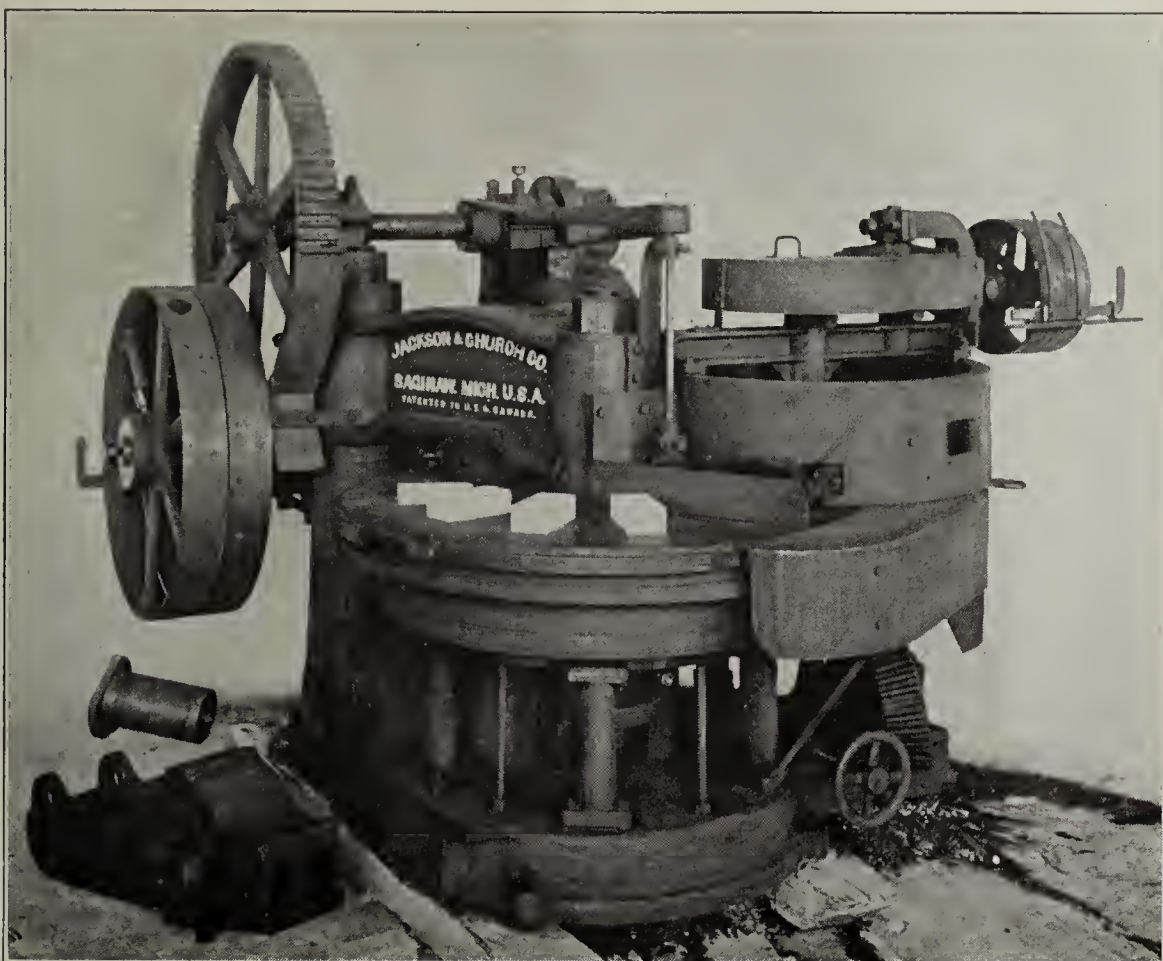
plants at fancy prices in places where by reason of poor materials or poor market conditions the plant had no chance of success. Jackson & Church machinery was never found in any one of these plants. Even where these promotions were well placed, it was frequently the case that the promoter cared more for his immediate profit than for the ultimate success of the business, and installed unsuitable machinery. Several such plants have been re-equipped by the Jackson & Church Company, and transformed into substantial successes.

One fixed policy of the Jackson & Church Company has been to keep closely in touch with all brick plants using their machinery, advising each of all improvements in processes, giving technical advice and in every way possible assisting in the production of a high grade article at a profit. That this service is appreciated is shown by the enthusiastic response invariably given by the users of their machinery when asked for an opinion as to its merits.

"In dealing with the Jackson & Church Company the writer has always found them absolutely reliable and fair and they have always given us the benefit of their improvements in both machinery and processes and also their service department has been prompt and always willing to do anything in reason to assist us."

One of the reconstructed plants is that of the Mouse River Brick Company at Denbigh, N. D. In a recent letter they say: "Our press is working fine and it is no trouble to fill our cylinder to the capacity with it every day, which is something unusual for us as you know what some of our past experience has been."

Another reconstructed plant is the Michigan Pressed Brick Company, Detroit, Mich. Writing to the prospective buyer they say: "We installed the Jackson & Church press, February, 1909, and find that it is the only press for making sand-lime brick. Our daily average for the year 1912-13 was 26,000, and this year our average is 27,000 per day in about eleven hours.



The Jackson and Church Sand-Lime Brick Press.

In a recent letter addressed to a prospective purchaser of sand-lime brick machinery, the Crume Brick Company of Dayton, Ohio, said:

"Our machinery purchased of Jackson & Church has been in continuous operation for nine years and we have always been able to make good brick and get out the rated capacity of the plant.

"Our hardening cylinders, two holding ten cars each of eleven hundred brick or 22M, is the capacity of our plant, and we are able to make this amount in about nine hours; if our cylinders were a little longer we could make 24M in ten hours.

"To show that we actually maintain capacity: we made last year in ten months 5,047,000 brick, the other two months were lost, being unable to operate on account of the flood here for some weeks, and the two weeks we always shut down for overhauling our plant.

"Our press is in good condition and fit for many years of service and is today producing brick as good as any made in the country and the whole outfit is rugged and simple, and the absence of complicated processes and machinery makes it possible to operate with very few stoppages.

"In January of this year we installed the Jackson & Church wet pan and storage hopper and it does the work very satisfactorily."

Along with the growth of their brick machinery business there has been an expansion of the sand-lime brickmaking interests of Messrs. Jackson and Church; they have installed plants from time to time at different nearby points until they now own control of and operate five sand-lime brick factories. They therefore have extensive first-hand experience with every phase of the business and the benefits of this experience they pass on to their customers.

As most readers of this paper are aware, sand-lime brick is a product composed of an intimate mixture of sand and hydrated lime, which after pressing are placed in steel retorts or cylinders where for a period of about ten hours they are subjected to a steam pressure of about 125 pounds, which hardens and cures them so that they are ready for the wall a day after being pressed; the product being clean cut and uniform in size and possessing strength and durability not excelled by even the best clay brick.

The Jackson & Church Company own a manufacturing plant covering one large city block and parts of

three others; it consists of a modern and well equipped foundry, machine shop, boiler shop and structural iron plant with the attendant pattern and blacksmith shops, storage warehouses, etc. The entire plant has been rebuilt within the past few years and has no superior for economical production of high grade machinery and boilers.

While the product of the factory includes pneumatic ash handling equipment, duplex engines for dredging and hoisting service, special machinery, tanks and structural steel work, its special attention is given to machinery for the brick and cement industries, including high grade tubular boilers, internally fired boilers of the Scotch marine type, heavy duty engines especially adapted to brick plants of all sorts, rotary kilns and driers, and its line of sand-lime brick machinery consisting of lime hydrating outfits, mixing and grinding machinery for both lime and sand, wet and dry grinding pans, rotary pans, rotary table brick presses, hardening cylinders, brick cars, turntables, etc. When Jackson & Church Company equips a brick

plant the entire outfit of the machinery is of their own manufacture.

plant the entire outfit of the machinery is of their own manufacture.

The Saginaw Rotary Table Brick Press is especially suited to the manufacture of sand-lime brick, but it has also been found better adapted than vertical presses for certain other products such as asphalt brick, silica brick and briquettes of various sorts.

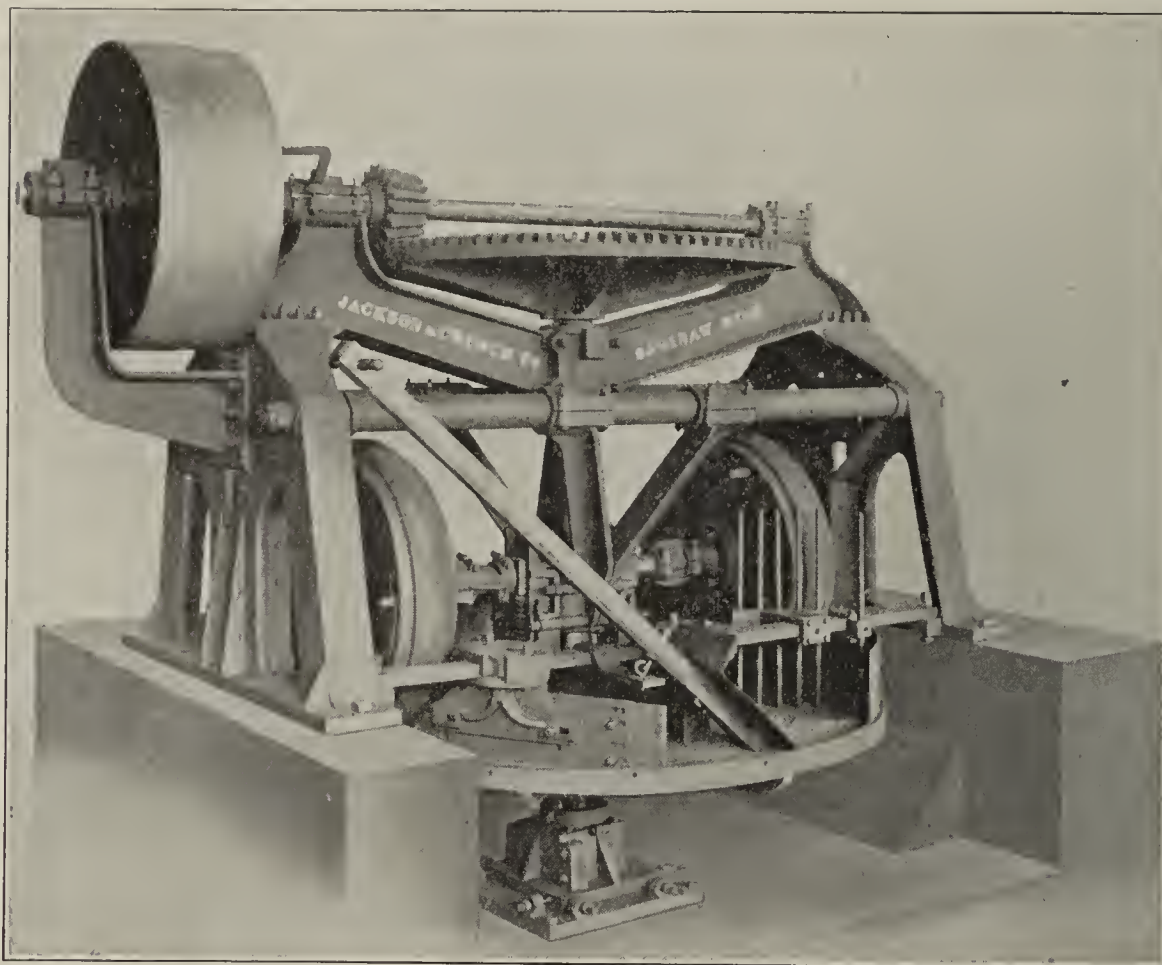
The rotation of the table is intermittent. In the period during which its rotation is interrupted, some of its pockets are being filled with material to be passed while others are receiving pressure, and yet others, as shown in the illustration, have forced the pressed product to the top of the table, where it is picked off by hand and laid upon transfer cars or other suitable conveyances. The pressed bricks are delivered as rapidly as two lively men can remove them, say, at an average of from 25,000 to 28,000 per day.

The design of the table has been carefully worked out to give maximum strength and wear resistance with minimum weight. Minimum weight means mini-

mum flywheel effect and consequently freedom from jar in stopping and starting. All wearing points, consisting principally of the pockets, are protected by linings or facings of hardened steel, so made as to be readily replaced at trifling cost.

The filling of the pockets, the pressure applied and the thickness of the bricks are under instant and easy control of the operators. Every convenience for adjustment, lubrication or operation suggested by ten years and more of constant use of these machines in a large number of plants has been provided for. The machine is thoroughly standardized, and repair parts when wanted are not only readily available and low in price, but are sure to fit and perform their service equally as well as the original parts.

A distinct advantage of the horizontal rotary table is that the pressed bricks are picked by hand directly from the face of the plungers on which they have been pressed and thus are not subjected to the breakage of corners inseparable from the operation of a vertical press. The design is such also as to permit of a very much better and surer method of filling the pockets.



The Saginaw Wet Pan, Which Is Also Made as a Dry Pan.

This press was designed originally for use in the first sand-lime brick factory in which Messrs. Jackson & Church were interested; has been supplied to every sand-lime brick plant which they have built for themselves and others; and having had their watchful care for years in their own plants and those of their numerous American and Canadian customers, has been brought to a degree of perfection that makes its users enthusiastic in its praise.

The "Saginaw" Wet Pan (which is made also as a dry pan) is a heavy, substantial and durable pan, designed for the exceptionally trying work of sand-lime brick factories. The Jackson & Church Company operated several sand-lime brick plants and after using the best pans it could buy, decided it would have to end the expense and annoyance of the continual breakdowns by building a pan so designed as to eliminate the weaknesses causing these troubles. The pan above shown is the successful result of this decision.

For the purpose of eliminating vibration and its resultant destructive tendencies it has been designed with short, stiff side frames of very massive section, securely tied together by a heavy bridgetree and by two large cross ties on each side; the bearings are brought close to the gears and provide an exceptionally rigid bracket for the bearing outside of the clutch pulley, and supply a strong cradle, braced to the two upper cross ties, to carry the inner ends of the muller shafts.

The table is extra heavy at points of strain, is faced to provide a true level seat for the wearing plates, and is thicker at this point than any other table on the market.

Bearing plates and muller rings are made of hard white iron to resist wear and are interchangeable. Provision is made for adjustment of the position of the mullers on their shafts so that their path of travel may be varied to suit the work and to completely utilize the entire surface of the wearing plates. A complete system of adjustable shovels, or deflectors, and stirring pins enables the material to be manipulated in any manner desired.

All shafts and bearings are of ample size and bearings are well lubricated. The lower end of the upright shaft has a hardened steel toe of large area, secured in a taper hole in end of shaft, running on a bronze step. The casing has an effective sand and dirt shield, and a side plate allows access for adjustment or replacement.

The gears are of heavy pitch and wide face and are of such ratio as to materially lessen the labor. The clutch pulley is powerful and effective and of such simplicity and dimensions of parts as to require practically no renewals of parts. Its usual size is 48 feet by 18 inches.

While the concern and manufacturing plant are large enough and sufficiently well equipped for economical production, the organization is small, so that the conduct of the business is under the personal supervision and direction of one of the four principal stockholders, John L. Jackson, president; A. G. Roeser, vice-president; W. L. Miles, vice-president and sales manager, and E. D. Church, secretary and treasurer. This assures the attention that is essential to the success of any manufacturing business and the satisfaction of its customers.

THE MAKING AND PLACING OF A GREAT BELT

By John H. Clayton*

Big things, those out of the ordinary, have an appeal to the senses that is lacking in the usual, be it of ever so fine workmanship or ever so cleverly conceived.

The Grand Canon is advertised as "Titan of Chasms." "See the Big Trees of California," runs the seductive headline tempting travelers westward. While the magnet impelling in the opposite direction declaims the unusual features of the Woolworth Building, "tallest office building in the world."

So it is that when the Chicago Belting Company set about the making of the mammoth 84-inch 3-ply Sea Lion Leather Belt for the main drive of the Puget Sound Mills and Timber Company, of Port Angeles, Washington, it realized that it was constructing something out of the ordinary, something which was not to be seen in a belting factory every day.

True, this is not the first 84-inch belt this company

has made. Some years ago belts seven feet wide were manufactured, for the Monarch Lumber Co., Portland, Ore., and the Dempsey Lumber Company, of Tacoma, respectively. But neither, though of equal width, was quite as long as this latest product.

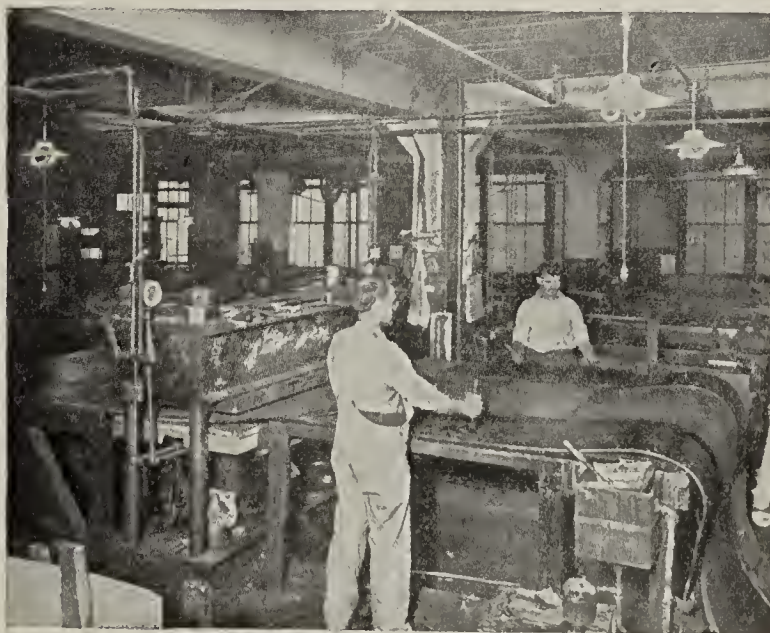


The present belt was sold by Mr. J. W. Mackenzie, manager of our Portland Branch.

Let us look at the figures: Seven feet wide, one hundred and twenty feet two inches long, three plies of leather, weight 2,639 lbs. It took the hides of two hundred and eighty-eight steers, or over fourteen carloads to provide the belting butts.

Converted into beef, the bodies of these steers would weigh 167,000 lbs., and would be valued at \$35,000.00 basing these figures on the average retail price of 21 cents a pound.

The per capita consumption of beef in the United States being 1¾ lbs. weekly, it can easily be seen that



On The Press—Rear View.

95,450 people would have meat enough for a week from the carcasses of these 288 steers. If one man alone essayed the colossal task of consuming this meat, on the same basis it would take him 1,835 years to complete the work.

Another angle of interest is the number of soles for men's shoes these hides would make. Here the figures, while not so large are equally emphatic. As each hide will make 50 pairs of soles, a simple computation gives us a total of 28,800 shoe soles, or bottom of footwear for 14,400 men. Stretched end to end these soles would measure five miles.

*Advertising manager, Chicago Belting Co.

Now a few words regarding the making of this belt, of interest to those of our readers who are not conversant with processes of manufacture of leather belting. Only A1 selected packer hides, tanned in the



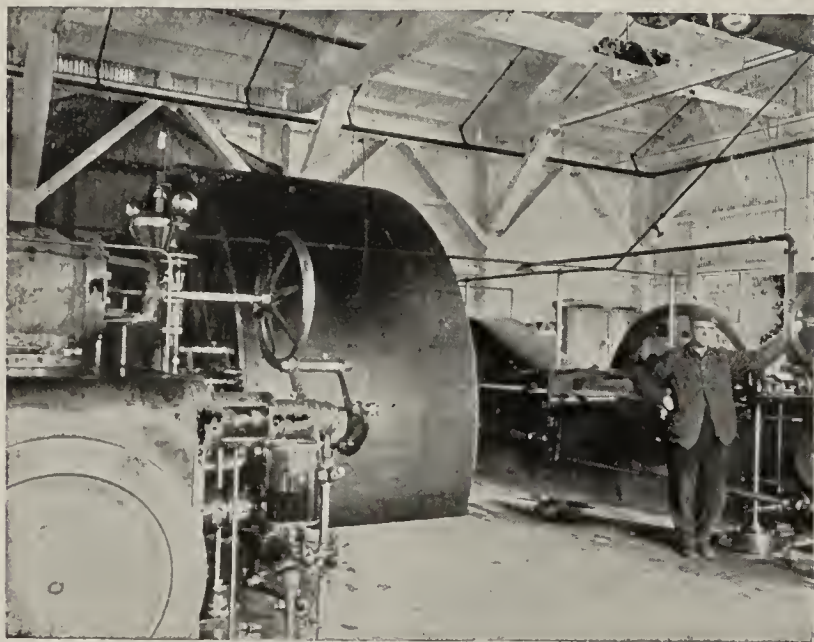
On The Press—Front View.

old-fashioned way by means of oak bark, are used. Our Sea Lion brand is cut from the center, where the hide is strongest, each piece used being not over 47 inches long and 30 inches wide.

After being cropped of shoulders and sides the hides are thoroughly scoured to remove the dirt of the tannery and to give the leather its first finish, when it is taken to the fleshing machines which remove all surplus flesh. From here each cut is placed on the drum of the setting out machine which smooths and evens the leather and sets the fibres.

In the currying department, where the belt next goes, the animal oils that have been taken out in the tanning are put back into the leather to make it pliable and adaptable for belting purposes.

After currying, each piece is placed in a stretching frame, stretched to the maximum without injury to



The Belt on the Pulleys.

the fibres, and removed only when thoroughly dry. The special care taken at this stage is the reason for our belting being so nearly stretchless.

The butt is then taken to the polishing machine where it is glassed and having received its high polish is now ready for the belt shop.

In the laying-out department it is sorted according to weight and thickness by an expert, and after being stripped up into desired widths the cuts are put

through the automatic scarfer which makes the lap. They are then pointed or feather-edged.

Here follows a particularly careful piece of work—the matching of the laps ready for joining, as a uniform thickness is imperative.

The belt is next taken to the pressman, who joins the laps with Sea Lion waterproof cement under a hydraulic pressure of 3,000 pounds to the square inch. Each pressman has his own particular stamp, with which he stamps every lap he joins, insuring the customer against careless work.

After leaving the presses the belt is taken to the finishing room, where it is dressed with Sea Lion waterproof dressing, a piece of work in the case of an 84-inch belt that requires the combined efforts of twelve or more men on account of the great weight of the belt.

It is then trimmed, wound and measured, ready for the final operation of polishing the edges.

NEW FAIRMOUNT CRUSHER

When the new crushing plant of the Michigan Alkali Co., Alpena, Mich., is put in operation, some time in the next two weeks probably, it will be the largest Fairmount roll crusher in operation in the world.

Work on the installation of the crushing plant has been completed recently and is undergoing a thorough inspection by H. Schifflin, general manager of the cement machinery department of the Allis Chalmers Manufacturing Co. of Milwaukee, and F. C. Burcell, Michigan sales manager for the company, of Detroit.

The new crushing plant of 6,000 tons capacity for a day of ten hours, more than doubles the capacity of the Alkali plant. The new crusher is one of three big steps in improvement taken this year by the Alkali Co., the others being the construction of the new steamer Huron and the building of a new steel dock. A new trestle has been constructed and the plant has been overhauled generally to make it harmonize throughout with the main improvements, costing in the neighborhood of a half million dollars, it is said. The improvements were started more than a year ago.

The new crusher, the largest of its type in the world, the Fairmount, represents the finest work of the Allis-Chalmers Co. The crusher is a horizontal cylinder, 72 inches in diameter and eight feet long, from which project a large number of knobs. The stone passes beneath the roller and into a bin below, from where it is taken by automatically operated cars which automatically open gates as they reach the bin, the stone falling from the bin to the cars. The various sizes and grades of stone automatically are sorted in a screen house.

The old crusher is an inverted cone with gyrating shaft in the center.

The old crushing plant will not be dispensed with entirely, but will be held in reserve, giving the plant a total capacity of 10,000 tons daily when necessary. It is believed that it will seldom be necessary to use the full capacity, for some time at least.

Concrete work has been done by the local company itself. The contract for the steel work was let to the American Bridge Co. The Great Lakes Dredge & Dock Co. had the contract for the dredging of the slip necessary for the new dock.

The new loading dock is south of the old dock and is practically a part of the old structure, forming a sort of double dock, at both sides of which boats may be loading at the same time.

In the past it has been necessary many times for one boat to wait for another to finish loading before it could get to the dock. This will not be the case next year.—Alpena News.

NEED FOR TESTING COMMERCIAL SANDS FOR USE IN CONCRETE

Abstract of Paper Presented to Indiana Engineering Society, by Prof. H. H. Scofield of Purdue University

Defects in natural sands which may cause concrete failures were enumerated as those having to do with composition of the sand grain, the granulometric composition and the moisture content.

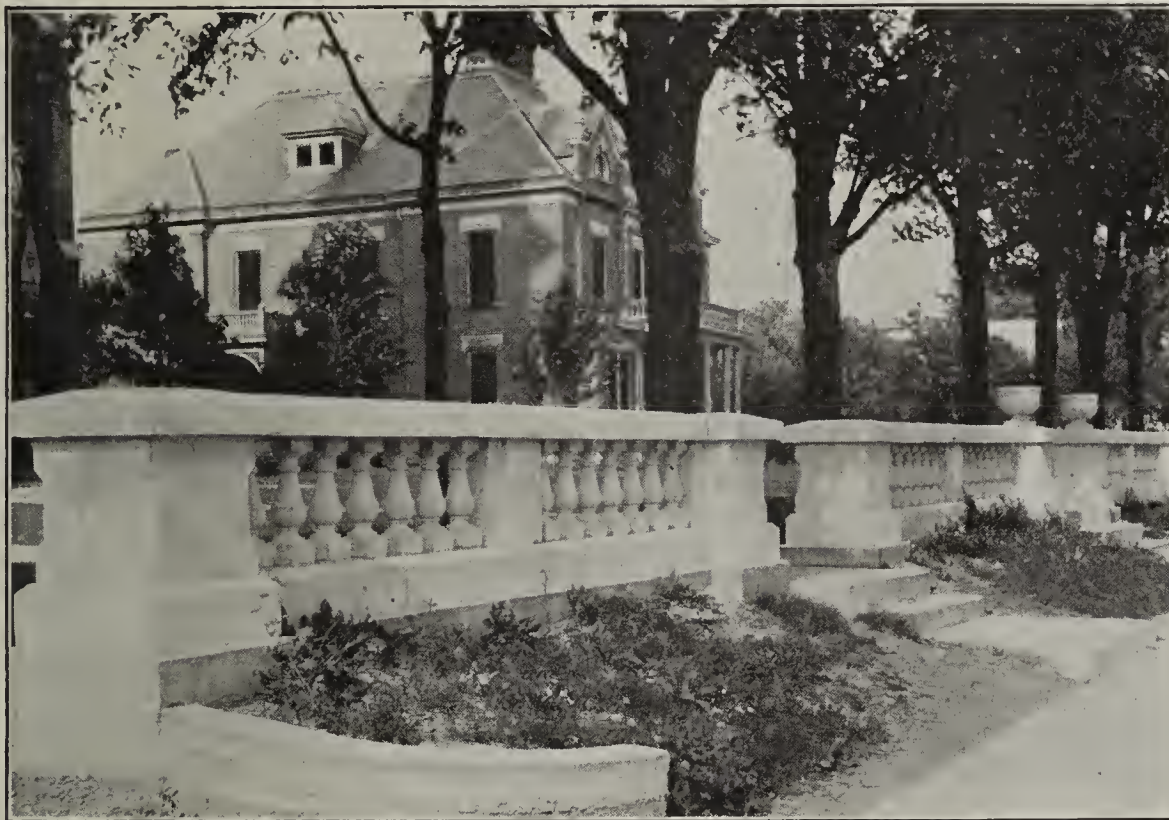
Of the first defect, hardness of the sand is an important item governing strength, and for that reason a high silica content is desirable. The grains should offer as great a resistance to shear and crushing as the cement does after attaining its best strength. The field test necessary to investigate these points is a critical examination, with or without a microscope, and this may not necessarily be exhaustive. Tests supplementing the ocular examination are needed. Organic acids may take the shape of a colloidal film around the sand particles, preventing the adhesion of

study of all fine aggregates indicates the straight-line gradation is best, the application commercially is simply to make up a sand in which 100 per cent passes the $\frac{1}{4}$ -in. sieve and 50 per cent passes a No. 8 sieve.

Sloppy mixtures with standard Ottawa sand and good natural sands lose 25 to 30 per cent of their strength, while poor sands may lose 70 or 80 per cent. This loss is explained as being caused by the greater dissolving action of the water and, in connection with the abrasion of mixing, by the wearing down of the softer, poorer particles, turning them into mud, thereby causing a decrease in strength and setting properties of the concrete.

THE DUNN BLOCK MACHINE

Speed, simplicity, durability and versatility are some of the virtues claimed for the Dunn Block Machine by their makers, the W. E. Dunn Mfg. Co., 4139 Fillmore St., Chicago. These machines have been improved and the 1914 models contain many little points of advantage not embodied in those of earlier design.



Concrete Balustrade
Fort Loramie, Ohio

Decorative concrete work of real merit is that of the Cement Tile & Block Manufacturing Co., Osgood, Ohio. Particularly handsome and attractive is a balustrade recently constructed in front of St. Michael's Church, Fort Loramie, Ohio, 172 feet in length, Medusa White Portland Cement being used in the facing in proportion of 1 to $2\frac{1}{2}$ of white sand.

The balusters are 6x6 inches at top and bottom, and 18 inches high, and were made in Simpson iron molds. All the other parts were made in wood molds, especially manufactured for this purpose at the plant. The newel posts are 24 inches square at the bottom and 30 inches high. The foundation is solid concrete, 36 inches deep and 14 inches wide at the top. This work was all hand made and tamped, and was kept thoroughly sprinkled for about two weeks.

The Cement Tile & Block Mfg. Co. are manufacturers of gray and white cement verandas, drain tile, etc., and as only experienced men are employed, and the best raw materials used, excellent results are being obtained.

the cement. Washing is the remedy. While small amounts of some mineral clays or fine siliceous silts are known to increase the strength and densities, others commonly contain vegetable matter which is entirely injurious to the setting up of concrete.

In spite of the specified gradation up to a $\frac{1}{4}$ -in. size, much sand is used which has no coarse particles at all, or else it has too great an excess of fine material. Tests on Lafayette bank sands for density in a lean 1:6 mixture as to strength, determined by 2-in. compression cubes, indicates that the densest mortar and the strongest are given by the straight-line gradation of sizes of particles. In the determination of the density on 1:3 mortars it was found that—the proportion of cement being constant—as a greater proportion of finer material is added to the coarser particles the density is practically constant until the straight-line gradation is reached. After that the addition of finer particles decreases the density. If a

The company asserts that when a man buys a Dunn Block Machine he has gone a long way toward equipping a complete concrete products plant, for the reason that one machine, with its various attachments, can be made to produce hollow block, veneer block, circular blocks, broken ashlar, chimney blocks, porch piers, door and window frames and angle blocks of any desired angle. In fact it can make any block necessary for a modern building.

The Dunn Block machine in addition to making three kinds of blocks—face down, side face and two piece wall blocks, the Dunn combination block machine guarantees every block made to be perfect. Our special off-bearing system removes all risk of breakage, says Mr. Dunn. It permits the use of a wet mixture which means stronger blocks with less tamping. Makes three sizes—8 x 16, 10 x 16, 12 x 16. Price \$40—sold on 15 days' free trial. Ask for a copy of our latest Block Machine Catalog.

Among The Cement Mills

TO HAVE STUPENDOUS BLAST

One of the entertainments to be given the Michigan Bankers' Association in their stay at Alpena, Mich., will be a stupendous blast of limestone at the Michigan Alkali Company's plant, a short distance along Thunder Bay toward North Point.

The limestone at the Michigan Alkali plant is as pure as is produced in any part of the world, being 98 per cent pure carbonate. This plant has a crushing capacity and output of 10,000 tons daily. The Huron Portland Cement Company is operated in connection with the Michigan Alkali plant and turns out 4,000 barrels of cement each day. J. B. Ford of Detroit is president of both of these companies. In drilling operations, the deep well method has been applied. The Loomis Machine Company, Tiffin, Ohio, has furnished 7 of their celebrated "Clipper" drills in this quarry and they are giving good service. Four Marion steam shovels are employed in this quarry and Allis-Chalmers Company's gyratory crushers are used exclusively. Recently a set of Fairmount crushing rolls was ordered, which will double the capacity of the crushing department.

to import any cement, for all parts of the country are now fairly well supplied with mills for the manufacture of Portland cement, and the supply of raw materials is practically inexhaustible. A significant feature of the cement industry, however, is the fact that, though only about 80 per cent of the normal cement-producing capacity of the country is employed at the maximum, there is often an overproduction; yet the exports of hydraulic cement have scarcely exceeded 4,200,000 barrels in any year, this amount being only about 5 per cent of the total output—not sufficient to take care of the surplus production in a year of great activity.

There seem to be excellent reasons for stimulating the export trade in cement as rapidly as possible, for, although the export of a relatively bulky and low-priced material such as cement does not promise large direct profits to an individual producer, indirectly the creation and maintenance of an export trade should benefit the industry at large through the opportunity afforded of disposing of surplus stocks and thereby tending to maintain steadier prices. Bulletin 599, U. S. Geological Survey.



Model 36 Revolving Marion Shovel Digging Rock in the Dexter Portland Cement Company's Quarry at Nazareth, Pa.

On the shore of Thunder Bay and running north along Lake Huron, there is an unlimited deposit of limestone, the greater part of which is as yet undeveloped. At Rockport, in the northeastern part of the county of Alpena, the Great Lakes Lime & Stone Company is having installed an immense plant that is very nearly completed. With the production of limestone and its by-products, and the unlimited supply of limestone at hand, there is sure to be a stable and continued growth of this thriving city of Alpena, as other factories are built on the basis of the limestone deposits and kindred industries.

The trip to the alkali plant will be a very interesting incident in the tour of the Bankers' Association.

COULD EXPORT CEMENT AT ONCE

The United States imports relatively little hydraulic cement, only 84,630 barrels having been imported in 1913, whereas the domestic production in that year was nearly 90,000,000 barrels. There is little or no need

STERLING CEMENT PLANT

C. J. Reilly, formerly general superintendent of the Sandusky Portland Cement Company, who has been acting as consulting engineer for the cement industry for the last 18 months, has accepted a position as chief engineer with the Sterling Cement Corporation, a company organized to take over and complete the mill of the Seaboard Portland Cement Co., near Catskill, New York.

The mill was originally designed to make cement using the dry process, but Mr. Reilly has decided to re-design and construct the mill to use the wet process. This decision was made after carefully going over the proposition, in order to get a more uniform mixture of the materials, to get better grinding of the raw material with less power and to eliminate the dust and loss of ground material in and about the mill.

All the machinery selected for building the plant will be modern in every respect, and they will have the mill in operation to take care of the early spring business, with a capacity to start of 2,500 barrels per day.

BEAVER PORTLAND CEMENT COMPANY'S NEW PLANT

Plant of the Beaver Portland Cement Company, at Gold Hill, Oregon, probably will be completed before the close of the year. J. C. Burch, president of the company, states that construction work is not being rushed because the demands for cement are not active; but the factory is expected to be ready for any building activity next year in which cement is a factor. Mr. Burch figures that highway construction during the next few years will consume large quantities of this material.

The construction of the plant is in the hands of the Hunt Engineering Company, Kansas City, B. L. Servey being that company's construction engineer on this work. The site is on the east side of the Rogue river, and occupies the west slope of a range of hills, making a gravity system feasible for handling material. The quarries of lime and shale are high upon the range and about 1,000 feet from the plant. A 900-foot surface tramway is being built from the quarry to the crushing plant. This consists of a double track on an inclined plane on which cars will operate by gravity—the loaded car down pulling the empty up.

The crusher and storage bins stand first in the chain of equipment. The crusher, which is in position, is a Gates No. 6 gyratory, having a crushing capacity of 500 tons per day. The pulverized material is carried from the foot of the crusher by bucket elevator to the storage bins which hold ten days' supply. These bins are of heavy mill construction on a concrete foundation, and have separate apartments for limerock and shale. The material is discharged through chutes into cars, for which there is a double track beneath the bins. They will use two-compartment cars, one each for the shale and lime, for hauling the crushed material over a trestle to the top of the raw grinding department where it undergoes wet grinding in a No. 45 ball mill, seven feet diameter by twenty-two feet long, reducing it to 85 to 200 mesh. The next step is to mix the pulverized lime and shale in bins, whence the mixture is elevated to a classifier, the fines passing to a tube mill, and the coarse returning to the ball mill for repulverizing. The tube mill product passes to slurry tanks in which it is subjected to agitation by compressed air. At this stage the material is ready for the kiln. The steel stack at the head of the kiln is nine feet diameter and 100 feet high, the first sixty feet being lined with fire brick.

The revolving kiln, ten feet diameter and 200 feet in length, is supported on three riding rings, and is fire-brick lined for 175 feet from the feed end. The hot zone of the kiln, about fifty feet in length, is constructed of three-quarter-inch steel plate, and the rest of lighter plate. The riding rings are set upon concrete bases.

The clinker, discharging from the kiln, passes through a rotary cooler, seven feet diameter by seventy feet long, and thence to the clinker grinding department, where a low per cent of gypsum is added. This is the final step in the cement making process, and what is now finished product is carried to the warehouse by belt conveyor.

The intention is to use oil as fuel for the kiln. It will be blown in through spray burners by compressed air. The kiln was shipped in three sections from Iola, Kansas. The steel stack and tanks were built by the Wilamette Iron & Steel Works, Portland. A machine shop and stock room occupy one building.

The machinery is to be operated by electric power, of which 1,100 hp. is required; and this will be supplied by the Rogue River Public Service Corporation. The motors required are as follows: Crusher, 50 hp.;

Kiln, 75 hp.; Ball mill, 200 hp.; tube mill, 200 hp.; air-compressor, 75 hp.; cooler, 15 hp.; elevators and screens, classifier and elevator, belt conveyor, screw conveyor, machine shop, 10 hp. each. These motors were sold by the Allis-Chalmers Company, through the San Francisco office.

The water supply, 60,000 gallons per day, is to be obtained from the town of Gold Hill. The rated capacity of plant is 1,000 barrels of cement per day.

A NEW BLASTING MACHINE

The economy of deep hole or well-drill hole blasting is responsible for its adoption by more and more cement, lime and stone quarries every year. The advantages are, economy of explosives, infrequent blasting, economy in drilling, and many other points. Deep well holes, however, have one disadvantage; they have so many dollars' worth of dynamite tied up in them that in order to insure against misfires, two or more electric blasting caps are used to prime each hole. In case the charges are broken, that is, where there is a seam of rock which offers little resistance, sand is put in that part of the hole instead of dynamite, and every broken charge requires one, and preferably two, electric blasting caps. This sometimes results in as many as four or five or more in each hole, and some of these may have wires as long as 100 feet. All this means increased electrical resistance. Power and lighting circuits are frequently used for firing these, but they have the disadvantage of having too high voltage for firing the electric blasting caps when connected in series, and not enough amperes when the electric blasting caps are connected in parallel. Parallel series connections require more care and knowledge in connecting up than is possessed by the average blaster.

The solution of this blasting problem is the use of the Du Pont New No. 5 push-down blasting machine. This machine is a recent development and is of improved design and workmanship. It has a capacity of 100 electric blasting caps so that it can easily take care of 20 holes, each one having 5 electric blasting caps in it, all connected up in series.

The series connection is much the easiest and simplest and is the only one possible for use with the blasting machine.

The No. 5 blasting machine is a strongly built piece of apparatus in harmony with the well-drill machines, steam shovels, crushers and other sturdy machines which progressive cement, crushed stone and lime manufacturers find necessary on their plant to keep abreast of the times.

LINK-BELT STEEL CHAINS AND SPROCKET WHEELS

Book No. 124 of the Link-Belt Co. of Chicago illustrates steel chains and sprocket wheels. It contains useful information as to details of size and construction. Where a size of chain is not illustrated in the booklet, the company furnishes information on separate sheets. The claims of the Link-Belt Co. for their products are the following:

"Without wasting expense on useless outside finish for appearances, we have taken advantage of every facility our experience, modern equipment and skilled workmanship can supply, to furnish a product which will have truer, smoother, harder, and thus more durable, bearing surfaces."

FIRST LARGE CEMENT BRIDGE

What is the first bridge of its size in the United States built entirely of concrete is located in Belleville, St. Clair County, Ill., spanning the Richland Creek on Main street, the most traveled road to St. Louis.

It was decided to build a bridge in 1895, but at that time skepticism was displayed by the city council in the selection of concrete.



Forty-Foot Concrete Arch Highway Bridge, Belleville, Ill.
First All-Concrete Bridge of Its Size in the United States. A. Geisel, St. Louis, Mo., Engineer.

Mr. A. Geisel, of St. Louis, Mo., the engineer, offered to build the entire bridge without any compensation until the bridge proved to be satisfactory and was accepted by the city council.

This is interesting because today most every bridge of any consequence is constructed of concrete as being the most permanent and economical type.

USING A WATERPROOFING COMPOUND WITH LEAN STUCCO MIXTURES

Permanently satisfactory stucco work is an end toward which contractors have been working for some time, and many different opinions exist as to the best mixture for stucco. The Standard Paint Co., N. Y. C., in a circular, (Book 82) recently sent out, calls attention to what is, in its opinion, the necessity of using leaner mixtures in stucco. This company manufactures "Impervite," a waterproofing compound, and recommends its use in stucco mixtures. The following paragraphs are quoted from its recent circular:

"Outside of settlement cracks, the chief cause of disintegration of stucco is the alternate expansion and contraction due to wetting and drying out. It has been proven that mortar contracts on drying (and expands on wetting) just as lumber does. This action keeps up for years, and is one of the principal causes of cracking, especially in stucco. It is the cement, however, which is affected, and not the sand; therefore, if the cement is diluted with a large proportion of sand the total effect is greatly reduced.

"Experience shows that a plain 1:3 stucco, properly applied, is safe from cracking, but is very porous. A 1:2 stucco, however, while less porous, is very much more liable to crack in spite of the greatest care in workmanship.

"This, then, is the dilemma which confronts the constructor; how to make a stucco lean enough to avoid cracks, yet non-porous enough to keep out water. The problem has been solved by the use of 'Impervite' as a waterproofing agent with a 1:3 stucco.

The leanness of the mortar prevents cracks, and the "Impervite" makes the mortar waterproof. This gives, the manufacturers claim, reliable results, both as to permanency of surface and permanency of water-

proofing. Send a postal to the Standard Paint Company, New York City, for their Book 82.

SASGEN PORTABLE DERRICK

In almost every line of concrete construction the derrick is a necessary part of plant equipment. Wherever the work requires the hoisting or handling of any considerable amount of heavy material, such as form



work, etc., the derrick is required. Much of this work, however, is not particularly heavy, and there is a consequent demand for a light but strong portable derrick, which may easily be moved from point to point.

Recognizing the demand, the Sasgen Derrick Company, 2053 North Racine Ave., Chicago, have offered a portable 1-ton stiff legged derrick weighing only from 600 to 900 pounds, according to the length of the boom. This machine can easily be put up or taken down by two men. This derrick is equipped throughout with crucible steel fittings, including a double drum geared winch, with a 2-ton capacity, arranged so that it can be used by hand, horse or machine power. The legs and sills can be swung in or out to any space or angle desired. The boom is furnished in lengths from 12 to 20 feet and may be used separately as a tower boom with the addition of only two extra fittings. The legs and sills are of 4 x 6-inch timber, while the mast and boom are of two pieces of 2 1/4 x 6-inch timber. The derrick is rated at 1-ton capacity, but will easily handle loads up to 3,000 pounds. Write the Sasgen Company for their new circular No. X and mention Cement and Engineering News.

VAN DUZEN CONCRETE MIXER WITH SIDE LOADER

The Van Duzen five-foot concrete mixer, equipped with side loader, is illustrated and described in a circular issued by the Van Duzen Roys Co., 4th floor, Hartman Building, Columbus, Ohio. The company states that at a slight additional cost over the standard mixer the attachment of a side loader practically doubles the output of the machine. It has solid and well-braced hoisting supports, and the hopper is tilted by an automatic hook which not only dumps it at just the right time, but also prevents it from riding on the chime of the mixing drum. It is operated from the same end of the mixer that the levers for dumping the drum are located, making it a one-man machine. The mixers are made with trucks 3 feet by 6-inch tread furnished with 18x4-inch steel wheels, or on broad-gauge trucks for use where the outfit is to be hauled considerable distances.

FENCE POST MOLDS

The W. E. Dunn Mfg. Co., 4139 Fillmore St., Chicago, manufacturers of the famous Dunn steel molds for cement fence posts make the following announcement, viz.: "Owing to the increasing volume of sales reducing manufacturing cost, the present low prices of steel, owning and operating our own complete equipped modern factory making all parts, with facilities of greater capacity and economy of overhead expense, we have decided upon a big reduction after November 1st. Our present prices are less than all others, but we desire to give the public best value for least money. Owing to the popularity and quality of the 'Dunn' mold, we look forward to a banner year for 1915. The reduction in prices coming at this time will enable the trade to secure equipment and supplies and make up a large stock of posts for the fall trade which is brisk during November, December and January.

We have issued a large, new catalog illustrating and describing in detail the construction of Dunn molds. Also the process of making, curing and using Dunn cement posts. Get your copy now. It tells why the "shaking system" is the only correct method of compacting wet mixture concrete—the only kind which makes the everlasting posts. Every mold is guaranteed and we have never been asked for the return of a single cent of the purchase price of Dunn cement post equipment. Concrete products plants in all parts of the world use the Dunn mold. We sell reinforcements of many kinds. Immediate shipments from stock. Send today for catalog."

NEW BOOK—"STEEL CONSTRUCTION"

"Steel Construction" is the title of a new book just published by the American Technical Society. It is

a text and reference book covering the design of steel frame work for buildings; by Henry Jackson Burt, C. E. This book is intended to give its students the facts and formulas needed in designing the structural steel framework for buildings. Since facts and formulas alone would be of little use, they are accompanied by explanations of the underlying principles, a clear understanding of which is essential to the intelligent use of the formulas. The use of the formulas is shown by illustrations of a practical nature which serve not only to teach the proper application, but to illustrate current practice in this form of construction. For use as a textbook by students, the important feature is the theory on which are based the formulas and their applications. A student can easily learn to use tables, apply formulas, and copy the work of others. But without a knowledge of the fundamental principles he will not be able to determine the proper limitations of the tables and formulas nor to distinguish the good and bad features of designs made by himself or others. Flexible leather, size 7x5 inches. Price \$2.75. Sent on receipt of price by Cement & Engineering News, Schiller Bldg., Chicago.

TRADE PUBLICATION

Erie Pump and Engine Works, Erie, Pa., has just issued Bulletin 29, containing 8 pages, dealing with Erie Class L low-head centrifugal pumps; 32 pages, Bulletin 30, sand or gravel dredging pumps; 16 pages, Bulletin 31, high-duty centrifugal pumps. These bulletins show and describe the subjects mentioned and have lists of prices of the equipment.

Stop Shoveling Your Profits Away



Get the Time-Saving, Substantial, Reliable, Economical Van Duzen Mixer, with or without side loader, used by hundreds of large and small contractors. Capacity 50 to 80 yards per day. Both the Price and Cost of Operation will surprise you.

Manufactured under Basic. U. S. Letters Patent
Jan. 24-05, Feb. 14-05, Jan. 29-07.

Our catalog fully describes these machines

The Van Duzen-Roys Co.
4th Floor, Hartman Bldg., Columbus, O.

Champion "Lightweight" Mixer

Hundreds of them now being used—every one proving satisfactory—owners would not part with them for twice what they cost.

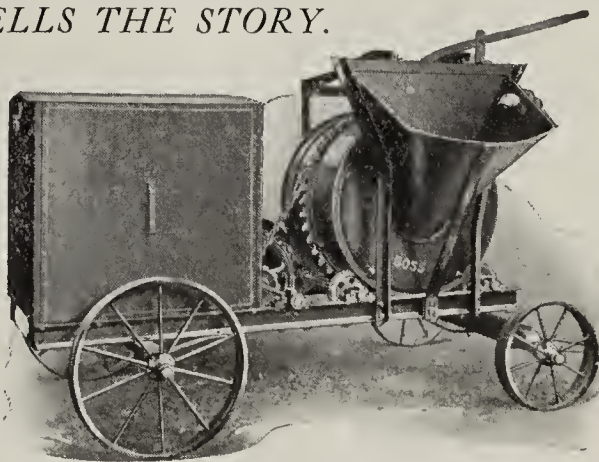
THAT TELLS THE STORY.

5-Foot

BOSS

"Highway
Special"

with
3H.P. Mandt
Engine



Low Loading Measuring Hopper gives this MIXER the speed of a side loader.

A Batch of "40 Times Mixed" Concrete a Minute

For long hauls over rough roads this outfit can't be beat—high wheels with wide tires, standard wagon track.

Hoist or Power Loader Can Be Attached

Price is Lowest
Ever Made

Strongest Guarantee
Ever Written

Steel King
10 FOOT SIZE

A LARGER MIXER
AT A LOW COST
BUILT OF STEEL

1000 pounds less material to pay for and drag around.

Write for illustrated catalogs

THE AMERICAN CEMENT MACHINE CO., Inc.
9635 JOHNSON ST. KEOKUK, IOWA

INVESTIGATION AND EXPERIENCE ARE PROVING THE RELIABILITY OF HYDRATED LIME

**FOR WATER PROOFING CONCRETE WORK.
IT IS NOT ONLY THE BEST BUT THE CHEAPEST
WATER PROOFING COMPOUND KNOWN.**

Architects, Engineers and Contractors everywhere are being interested in and are investigating the worth of Hydrated Lime as a water proofing. Experience and actual application are proving to them beyond shadow of doubt that Hydrated Lime is reliable, permanent and harmless.

Concrete Tank for Smudge-Pot Distillate in California

Reservoir Oil-Proofed by Adding 10 Per Cent of Hydrated Lime to Concrete.

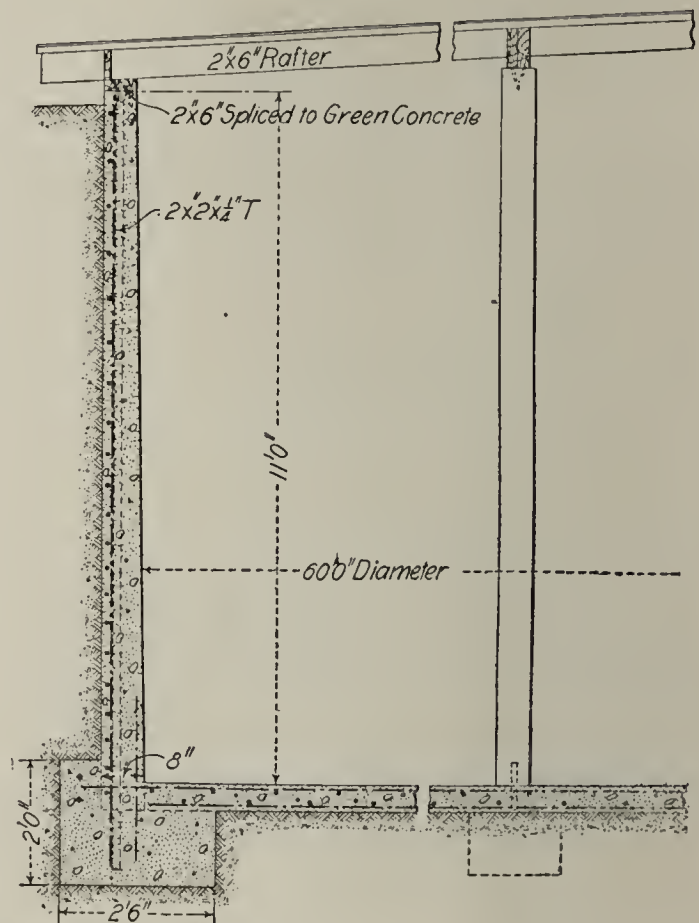
ABSOLUTE assurance of having material on hand for smudging in the citrus belt of Southern California, when a falling temperature requires this measure, has led to the storage on the ground of "slop distillate," a local name for the low grade oil used in the smudge pots. Many supplies for the individual grower are handled by the association which packs and sells his output. At Narod the West Ontario Citrus Association has recently constructed a reinforced-concrete distillate reservoir of 235,000-gal. capacity, sufficient to carry the orchards over the low-temperature period. It is 60 ft. in diameter and 11 ft. deep.

Many attempts have been made with varying degrees of success in building reservoirs of concrete which would be impervious to oil, as even the heavy grades of crude oil will permeate walls which are watertight, but the lighter grades of oil and distillate are harder to confine. The engineers report that the Narod tank has been filled with distillate for more than six months without any evidence of seepage.

A section of the wall is shown herewith. Eight 6x6-in. redwood posts, 15 ft. from the center post, support the composition roof laid on top of $\frac{1}{2}$ -in. sheathing.

The floor is reinforced top and bottom with $\frac{1}{2}$ -in. rods spaced on 12-in. centers both ways. The concrete block under the wall extends 8 in. beyond the outer edge of the wall and has a rim against which the 8-in. non-battered wall abuts. Horizontal wall joints at the end of a day's run consisted of a bond of No. 27 galvanized iron sheet 6-in. wide, embedded half its width in each day's work.

Oil-proofing was accomplished by adding 10 per cent of hydrated lime to the concrete during the mixing operation. Mayberry & Parker, architectural engineers, of Los Angeles, designed the tank, which was built by L. Fleming of Pomona, Cal.



SECTION THROUGH WALL OF NAROD TANK

See next page for list of lime manufacturers who make hydrated lime and who will gladly furnish you samples, circulars and any information you desire.

FULLER QUALITY PRODUCTS CATALOGUE NO. 50

In presenting this catalogue (cancelling all previous issues) covering sprockets and traction wheels and our general line of chilled charcoal iron castings for all uses, we invite your careful investigation, which we feel confident will demonstrate the superior merits we claim for our products. We have made chilled iron castings of every description since 1867 and our products represent the highest point of development, writes the Lehigh Car Wheel & Axle Works, Catasauqua, Pa.

Our material is specially adapted to resist abrasion and we claim for it lowest ultimate cost. The extensive use of our products we offer as proof of our claim. We are specialists in this line of service and if you will kindly tell us your particular requirements we will be glad to give you full information and prices.

Effective November 2, 1914, all orders for sprocket and traction wheels will be billed in accordance with revised prices published in catalogue No. 50. We solicit your inquiries. Write for discount.

WHITE CEMENT

The Sandusky Portland Cement Co., consigned to San Francisco yesterday three carloads of white cement, which were routed through the Panama Canal and are believed to constitute the first shipment of white cement from New York, Ohio and Illinois to be forwarded for shipment through the "big ditch."

JEFFREY LIMESTONE PULVERIZER

The Jeffrey Manufacturing Co., of Columbus, O., reports that the large demand for road construction and repair work and for crushed limestone for agricultural purposes which is going on at the present time has created additional demand and considerable sale for its swing-hammer "Type D" pulverizer, illustrated



and described in bulletin No. 132 recently issued by the company. The Jeffrey limestone pulverizer produces material one-quarter of an inch in diameter and under for the top dressing or filler, which makes an excellent binder material for water-bound roads. The bulletin will be sent to interested persons upon request to the company.

HYDRATED LIME

Its Marvelous Increase in Consumption

is due to its successful and growing use in various kinds of cement work. It is only necessary to mix the two and any desired proportions can be employed. For laying brick and stone a mixture of 25 parts cement and 75 parts hydrated lime is quite popular. (One bag of cement to three 100-lb. sacks of hydrated lime.) The addition of the cement does not appreciably detract from the plasticity of the mortar, while it adds greatly to the strength, particularly at early periods. For stucco, the proportions are generally reversed, (one 100-lb. sack of hydrated lime to three sacks of cement,) the hydrated lime adding to the plasticity of the mortar and making it spread more easily. It also makes a lighter colored stucco and adds to its density. For making concrete building blocks, about 15 parts of hydrated lime and 85 parts of cement are used (or one 40-lb. sack of hydrated lime to two sacks of cement.) It has been found that up to 15% of hydrated lime does not detract from the strength of cement mortars.

Write for printed matter, information, etc., to any one of hydrated lime manufacturers listed below—the nearest to your city

LONGVIEW LIME WORKS,
BIRMINGHAM, ALA.

CHARLES WARNER CO.,
WILMINGTON, DEL.

MARBLEHEAD LIME CO.,
CHICAGO, ILL.

OHIO & WESTERN LIME CO.,
HUNTINGTON, IND.

SECURITY CEMENT & LIME CO.,
HAGERSTOWN, MD.

LEE LIME CO.,
LEE, MASS.

CHARLEVOIX ROCK PRODUCT CO.,
CHARLEVOIX, MICH.

WHITE MARBLE LIME CO.,
MANISTIQUE, MICH.

GLENCOE LIME & CEMENT CO.,
ST. LOUIS, MO.

DUTCHESS COUNTY LIME CO.,
DOVER PLAINS, N. Y.

ROCKLAND & ROCKPORT LIME CO.,
101 PARK AVE.,
NEW YORK, N. Y.

CHARLES WARNER CO.,
103 PARK AVE.,
NEW YORK, N. Y.

KELLEY ISLAND LIME & TRANSPORT CO.,
CLEVELAND, OHIO

NATIONAL LIME & STONE CO.,
CAREY, OHIO.

JOHN D. OWENS & SON CO.,
OWENS, OHIO.

CHARLES WARNER CO.,
LAND TITLE BLDG.,
PHILADELPHIA, PA.

NATIONAL MORTAR & SUPPLY CO.,
PITTSBURG, PA.

GAGER LIME & MFG. CO.,
CHATTANOOGA, TENN.

DITTLINGER LIME CO.,
NEW BRAUNFELS, TEX.

ROUND ROCK WHITE LIME CO.,
ROUND ROCK, TEX.

RIVERTON LIME CO.,
RIVERTON, VA.

INTERNATIONAL LIME CO.,
SUMAS, WASH.

STANDARD LIME & STONE CO.,
FOND DU LAC, WIS.

UNION LIME CO.,
PARST BLDG.,
MILWAUKEE, WIS.

PORTLAND CEMENT AND RETAIL DEALER

By William Walter Smith*

The members of the Southwestern Lumbermen's Association, both as individuals and as an organization, have done a work in the development of this great Western and Southwestern country of which you may well be proud. Some of you recall the time when many of your customers lived in sod houses. Incidentally the sod-house farmer was not a good customer. The same is true of the man whose home was the log cabin. From a business standpoint, these men, fine as they were, were not good customers—they had not the means to purchase building materials and had, therefore, to be content with sod and logs. But by pluck and ambition they wrung their wealth from the soil and are today living in comfortable homes built of materials which you have sold to them. However, in your business transactions, you have been more than mere salesmen of building materials. Many a man you have carried on your books when his livestock was wiped out by blizzards, or his crops burned up by hot winds or carried away by floods. You have been banker. You have been general adviser. You have always stood ready to tell your customer what was best for his interests. Why? Because of your knowledge of this fundamental business principle: "The greater the wealth of a community, the greater its purchasing power."

It was undoubtedly with this basic principle in mind that you began to handle Portland cement. The people demanded it. You supplied them. Glance over your books for the past ten years and you will find that your general business has increased in about the same proportions as your sales of Portland cement. Gentlemen, the cement industry is proud of its product. It is likewise glad to have as retail dealers such well-informed and broad-minded men as comprise the Southwestern Lumbermen's Association.

The present importance of Portland cement as a building material may well be understood by the fact that from 1900 to 1913 the consumption has increased from 8,500,000 to 89,000,000 barrels. Undoubtedly there is a great demand for cement, and its use is benefitting not only the general public but also the retail lumbermen, both directly and indirectly. The fact that concrete foundations are permanent encourages the farmer to invest more money in a good corn crib or any other building. The retail dealer sells him not only more and better lumber, but also the sand, the gravel, the crushed rock and the cement for the foundation. Moreover, without loss of time in waiting for masons, the carpenter can make the forms, mix the concrete, and build the foundation for the crib.

Consequently in a year one carpenter can erect more structures which call for more building materials, supplied by yourselves. The same is true of a basement barn. Most certainly permanent foundations effect a saving for the farmer and increase his wealth. The wealthier a community, the better it wants to live. As a result the more it can buy, the more it will buy from the retail dealer. The farmer and ranchman are just as anxious to keep out of the mud as the town dweller, and cement sidewalks are good business everywhere for the building supply man.

Much as you hear about engineers who originated permanent concrete roads, I am inclined to think that some retail dealer first conceived the idea of concrete highways and advised this farmer to pave

the alley-way between his structures so that he could haul feed from the silo. A good silo of any kind is a good investment. From this alley-way pavement of concrete most certainly originated the concrete feeding floor for farm animals. By means of the concrete feeding floor, such a saving in feed and time of fattening is effected that the United States Government has issued a free bulletin telling how to build them. This same bulletin treats of concrete manure pits, and concrete dipping vats for cattle, sheep and hogs. Dipping eliminates the cattle tick, the scabies-mite of sheep and vermin on hogs. The use of concrete for feeding floors, manure pits and dipping vats means just so much extra business dropped out of a clear sky into the lap of the dealer, for no other material but concrete is suitable for surface and underground construction. We of the cement industry from actual experience know that there are occasions when a man can smile at the question, "How's business?"

At times it is rotten as punk and you feel just like saying so. To me it has been interesting to observe how some dealers, instead of wearing out their religion, "go gunning" for business. In the neatest lumber yard in many a mile, and not far from this city, I noticed some semi-circular wooden frames. To my inquiry the dealer replied: "Those are 'business boosters.' Nearly everyone around here wants a concrete storm cellar. Those half-circles are ribs for supporting the concrete in the roof until it hardens. I rent the ribs for one dollar—much cheaper than a man can make his own—therefore everyone who builds a storage cellar borrows my centers. Incidentally I sell the lumber for the forms, the cement and the sand and rock for the concrete. Sure it pays."

Other dealers use the same general scheme for concrete watering troughs for livestock, for cisterns, etc. By such means new customers are obtained, satisfied and held; and at the end of the year it all shows on the profit side of the ledger. Often a dealer can so interest a sidewalk builder, a carpenter, a mason or a mechanic that he will take up this small work in concrete construction. There is now a great demand for permanent concrete bridges and culverts. Why should not the local dealer sell the material, why should not the local contractor build the concrete bridges and culverts and thereby keep at home most of the money invested? Moreover, in connection with his yard, the retail lumber dealer often owns and operates a sand and gravel pit or a rock crusher. Such a business is very profitable.

Cement manufacturers are interested in cement even after the order is sold the local dealer. Cement is a material very sensitive to moisture. It is purposely made so. Therefore all moisture must be kept away from it until water is added in making the concrete. To prevent "caking" of cement in bags, every cement dealer should have a perfectly dry storage house. Such a building is not expensive and is a paying investment. The roof must not leak. The sides must be proof against driving rains and sifting snows. The floor must be entirely clear of the ground and all danger of dampness. Better still is a double floor—a false floor laid over the regular floor. The structure should have at least skeleton lining so that the piles of cement can not touch moist outside walls.

"Caking" of cement occurs generally in winter. This action is both easily explained and prevented. You have seen drops of water gather on the outside of a pitcher of ice water on a hot day. Those drops of water are formed by the vapor or steam in the air being condensed or coming into contact with the cold surface of the pitcher. The caking of cement is produced in a similar manner. Prolonged cold weather brings the cement down to the same low tem-

*Address delivered before Southwestern Lumbermen's Association.

A FIVE MILLION DOLLAR MARKET

Do you know that this big market for concrete work is ready and waiting in the greenhouses of the United States? Do you know that the American people lavish thirty-five millions of their wealth upon flowers every year and that eleven thousand greenhouse establishments are busy filling the demand? Do you know that the flowers are cultivated on elevated benches and that twenty-two hundred miles of these benches in use are constructed of wood?

Seven years is the average life of a wooden bench. During the next seven years these twenty-two hundred miles of benches must be replaced at a cost of over five million dollars.

Six years ago a florist combined genius with an intimate knowledge of the requirements for successful cultivation of flowers and adapted concrete to this use. The final result of his developments is the Wilson-Hoyt Concrete Bench—a bench which in design perfectly meets the needs of the grower—and a system of construction so complete and simple that the grower can now install benches of concrete at about the cost of wood.

From the first the Wilson-Hoyt Bench found popular favor with the growers. The ones who first tried them returned to us for more—and then we were sought out by other growers who learned of the advantages that could be derived. In time the Hentz range at Madison, N. J., was fully equipped with thirty-six benches each 175 feet in length. Other establishments like Lum's big range at Chatham, N. J., and Marti's at Arlington, N. J., followed the example.

And then the demand spread farther out. Marquardt at Middle Village, N. Y., equipped his range; Darlington at Flushing, N. Y., did the same. Lone Oak greenhouses at Babylon, N. Y., constructed twenty; Davis at Berwick, Pa., thirteen; Adgate at Warren, Ohio, equipped his range and Frey at Crown Point, Ind., installed a dozen. And so on the demand for Wilson-Hoyt Benches increased and spread until we can not attempt to meet the demand from all parts. And there are two excellent natural reasons for this demand. First: the Wilson-Hoyt Bench is sanitary and gives better production than the unsanitary wooden bench. Second: the concrete bench can save the American florists an up-keep cost amounting to nearly a million dollars a year.

If we can find sixteen live concerns who will satisfy us of their ability to handle a proposition of this size and nature, we will share with them the benefits of the reputation this bench has already won. We will divide the field into sixteen parts. We will assign exclusive territory; requiring only an investment in equipment which is ridiculously small compared with the results to be derived.

If you wish to step into a field that is big and unscathed by competition write to us and we will unfold a proposition of striking possibilities and profits.



Mead-Suydam Company

371 Park Avenue

NEWARK, N. J.

perature as the outside air. Sheltered by the shed, there it remains. During the mid-day, or in a warm period, the doors and windows of the cement house are thoughtlessly left open. The moist, warm air enters, strikes the cold bags of cement—and here again we have the pitcher of ice-water on a warm day. The small drops of water form but are immediately absorbed by the dry cement. Thus the bags of cement cake.

To prevent caking never store cement where it will be subject to drafts, as in the open driveway of a double shed. Keep all windows and doors closed all the time except when in use. Pile the cement so that there will be as little air space as possible between the bags. Many dealers report good results from a piling method known among brick masons as "headers and stretchers."

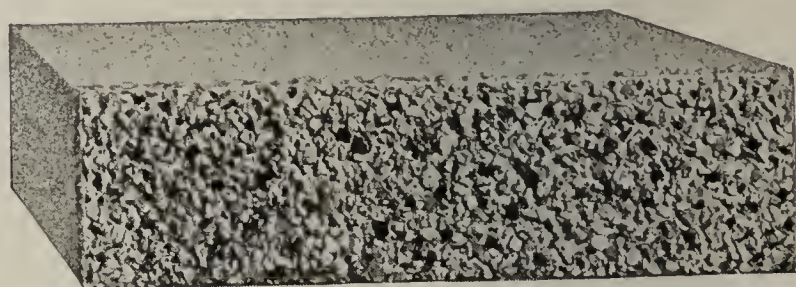
As time goes on more and more cement will be used. Newspapers and magazines of all kinds tell of the uses of concrete. The public demands this information. We all must keep step with the march of progress. Whenever your customers want information about concrete, write the cement company whose brand you handle. They will supply you, free of charge, with bulletins and small plans which will increase your business. As a dealer's orders for cement increase, quite naturally he will be given more consideration, more accommodation and more protection by his cement company.

Most certainly do concrete foundations, concrete feeding floors, concrete bridges and concrete improvements in general tend to increase the wealth of a community. So bear continually in mind this basic business principle proven throughout all civilization. The greater the wealth of a community, the greater its purchasing power and the greater its desire for permanent improvements. In other words, prosperity is always passed around.

GRANITE-FACED CEMENT BRICK

Surface texture in brick is an element of ornamentation on which great stress is now laid. It is produced in various ways; but one of the most effective consists in an application of a facing or veneer of rock crystals. An example is shown in photographs in their new catalog which is that of a granite-faced brick molded on a Helm press brick machine, made by the Helm Brick Machine Company, 16 Bank Bldg., Traverse City, Mich. It reproduces with exquisite faithfulness all the texture, color and beauty of the natural stone.

The process is not costly, involving only about an hour's extra labor on a thousand brick, but giving distinction and adding immensely to the beauty of the product made from ordinary cement, sand and gravel.



It is also so simple that the unskilled novice can handle it successfully.

Every community offers a rich field of opportunity for the introduction of this beautiful product, which sells at a profit of even over 100 per cent above the cost of manufacture. The Helm press, and in particular this facing process, are, therefore, well worthy of careful investigation. The Helm Brick Machine Company will tell you more about this than we can just now. Write them at the above address.

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For Dependable Service



LOCOMOTIVE CRANES occupy today a highly important place in the art of handling materials. In the one machine is combined a portable hoisting engine, swinging derrick, grab bucket unloader and switch engine. Their adaptability to a wide range of service and conditions finds for them increasing applications.

The Link-Belt standard Crane is a machine of all-round utility; it is driven by steam or electricity, and equipped to operate Grab Bucket, Hook Block, Electric Lifting Magnet, Drag Scraper Bucket, Steam Shovel Dipper and Pile Driver.

Write for our New Locomotive Crane Book No. 158

We also design and build: Coal and Ashes handling Machinery, Elevator and Conveyors for all materials, Belt Conveyors, Bucket Carriers, etc.

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CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—1117 Schiller Building

Telephone, Randolph 934 Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, two years for \$1.00;
all other countries, \$1.00 per year.

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JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, DECEMBER, 1914

EIGHTH CHICAGO CEMENT SHOW.

With the greatly increased use of concrete as a paving
material, the annual Chicago Cement Show is
making more and more appeal to those having to do
with road or street construction.This year a large number of exhibits will be devoted
to this important and rapidly developing use of con-
crete. There will be road building accessories, such as
automatic striking devices, bridges, steel side forms,
joint protection plates, joint fillers and installing de-
vices. In addition to this there will be shown road
models and diagrams illustrating the best practice in
concrete road construction, together with a large
amount of data which the road engineer or commis-
sioner will find of value.Contractors will find it worth while to familiarize
themselves with new and improved road equipment, of
which perhaps the most important is the special street
paving mixer.Competing manufacturers have been bending every
effort to the improvement and the refinement of these
comparatively recent machines, and can be relied upon
to present a most interesting display.The date for the show is now only a little more than
three months distant, and road builders should make
early plans to attend.BULKHEAD TO RESIST UNIT PRESSURE
OF 200 POUNDSA paper by S. L. Wise and W. Strache, published
in the August Bulletin of the American Institute of
Mining Engineers, deals with the design, construc-
tion and cost of two mine bulkheads. The tunnel is
in the Hibernia magnetite mine, New Jersey, and was
formerly closed by a mass of rock of indeterminate
thickness, which leaked about 6 gal. per minute and
showed signs of weakening. It was determined to
build a new bulkhead across the tunnel, which is
rectangular—12 ft. 4 in. wide and 7 ft. 4 in. high.A tapered recess 3 ft. deep and 10 ft. long at the
upstream end of the bulkhead was cut at all sides of
the tunnel with the longitudinal faces intersecting the
walls of the tunnel at the downstream end, thusmaking provision to receive the bulkhead, which has
the form of a truncated pyramid with a vertical base
13 ft. 4 in. x 18 ft. 4 in. upstream, a top 7 ft. 4 in. x 12
ft. and a horizontal length of 10 ft. between base and
top. The concrete is reinforced by two sets of 30-lb.
rails in vertical planes curved to horizontal radii with
the convex surface upstream, one of them 2 ft. and
the other 7½ ft. from the upstream side of the wall.
Each set consists of five horizontal rails and nine
vertical rails spaced 2 ft. apart and wired together at
their intersections. The bulkhead wall is pierced by
an oval 16 x 24-in. steel manhole with hinged, bolted
and gasketed doors, and by several 3-in. and 5-in.
valved drainage pipes. The heavy pressure exerted
on the upstream face tends to drive the wedge-shaped
bulkhead against the tapered surfaces of the rock and
produce compression in the concrete, which, however,
is made with vertical front and rear surfaces so that
the theoretical arch developed is invisible.The recess, comprising about 50 yd. of excavation,
was very carefully blasted out by hand-drilled 1-in.
holes about 3 ft. long and from 12 to 18 in. apart. The
recess was cleansed and washed and the rock surface
plastered with 1:1 cement mortar before placing the
1:2:4 hand-mixed concrete against ordinary wooden
bulkhead forms.

Waterproofing.

The pressure face of the bulkhead was covered with
3 in. of semi-liquid Impervite waterproofing compound
deposited behind steel plates built up with the con-
crete. The work was not continuous and whenever
it was interrupted sharp stones weighing about 100 lb.
each were set 6 in. apart in the upper surface of the
concrete mass projecting from it and plastered with
1:1 mortar when the work was resumed. When the
roof was reached false forms were placed and the
work was finished with tightly bonded dovetailed
blocks. Seven 2-in. grout pipes, four on the pressure
side and three on the opposite side, were placed in the
concrete as the work neared completion. Thirty-six
hours after the concrete was finished grout made with
1½ parts of sand and 1 part of cement mixed with
water-dissolved Impervite was forced through the
pipe under a pressure of 85 lb. per square inch. Two
weeks after the completion of the bulkhead it was
subjected to a pressure of 160 lb. per square inch. The
result was a seepage of only one ½ gal. at first, and
this afterward almost entirely ceased. "Impervite" is a
guaranteed waterproof manufactured by the Standard
Paint Co., New York, N. Y. Send a postal today for
their Book 82.

DEATH OF ARNOLD F. GERSTELL

The many friends and business acquaintances of
Arnold F. Gerstell, the president of the Alpha Port-
land Cement Company, Easton, Pa., were shocked
when they learned of his sudden and totally unex-
pected death on October 16th. Mr. Gerstell was one
of the most widely known men in the cement manu-
facturing business, and the head of one of the largest
companies in this country. He had been in excellent
health, but died very suddenly on the evening of the
above date at his home in Easton.In 1909 he was made president of the company,
which position he occupied until his death. During
his connection with the company it has grown to be
one of the largest and best known cement companies
in the country, operating plants at Manheim, W. Va.,
Alpha, N. J., Cementon, N. Y., and Martin's Creek,
Pa., at which places there are six mills turning out
25,000 barrels of cement daily.

A Concrete Wall of Great Beauty

Until a year ago the Lake Michigan beach at Dempster Street, Evanston, Ill., was a low sandy expanse, unattractive and unimproved. Today the Lake Shore Drive passes several substantial residences at this point, which stand on filled ground. Ernest Mayo, Architect, of Chicago, was retained by the owner of part of the property facing Dempster Street but with 200 feet of lake exposure, to design a residence for himself and another for his son and to make maximum use of the lake view. The architect's plans called for a wall surrounding the grounds within the sidewalk limit, which would permit placing the house eight feet above the prevailing grade. There were to be entrances for each of the houses and a carriage entrance common to both. As worked out there are now 400 feet of wall surmounted by a balustrade on the two outer exposures and 400 feet of plain wall on the inside. While the wall is entirely dissimilar in archi-

Three distinct grades of concrete are used in the wall. The footings, the body of the wall and the pilasters are of a 1:3:5 mixture of plain concrete; the facings of panels and pilasters of a rather dry mixture of cement and limestone screenings ranging from $\frac{1}{8}$ to $\frac{3}{8}$ of an inch in size and containing no dust; and the belt courses, the balusters and the railings are of a cement and coarse sand mortar. The dry facing mixture was placed in the forms with the body concrete and kept separate by means of a metal division plate which was raised as concreting progressed and prevented the slushing of grout through the porous facing. This system was used with perfect success and only a minimum of patching was required. There was no attempt made to improve or change the surfaces after the removal of the forms.

Forms for the panels were built up to the balustrade level on footings 4-feet deep and each panel was a



Concrete Wall Surrounding the Residence of Mr. I. B. Cook, Evanston, Ill.

tectural treatment from the residences, it is the more effective because its material, concrete, is perfectly adapted to its purpose—that of retaining a sand fill, and is of such perfection of workmanship as well as of design as to make it a feature of considerable interest.

The wall consists of pilasters on 12-foot centers, 7-foot panels between, and above the panels a balustrade surmounted by a railing continuous around the entire wall. The entrances are designed with the same simple dignity. The chief beauty of the wall lies in the simplicity of the design and in the rich texture obtained in the concrete. The illustrations adequately show the range of surface texture and need not be described. The method of construction, however, is of considerable interest and involves some problems which are unusual in concrete construction. The very perfection of the work required a more perfect system of form building than is commonly used and the resultant work shows that perfection of detail can be readily obtained with concrete if proper care is taken in every step of the work.

separate unit, the pilasters being cast after the panel forms had been removed. The smooth cove filler above the footing course was not included in the first casting but was applied by means of a wooden template after the panels and pilasters had been completed, the roughness of the facing giving an excellent bond. The forms were filled up to the level of the smooth belt course using two concrete mixtures. At this point the surface material was changed to a cement mortar giving a smooth texture for the belt. Short sections of pipe were set into the upper surfaces to receive the dowels of the balusters. Enough forms were constructed so that ten panels could be built at once.

Following the removal of the forms for the panels, the pilaster forms were set up and an expansion joint provided at each second panel. The pilasters were cast with a change of surface aggregate at the belt course level and again for that part extending above the belt. The balusters had previously been cast in glue molds with steel dowels set in both ends. These were set up and grouted into the panels. A

form was then constructed around the heads of the balusters, light reinforcement placed and the railing cast in one continuous piece. This rail included the heads of the pilasters which were of the same design and were readily cast with the rail. The form for the rail consisted of a simple box with a molding set in the sides and was run with a cement mortar. The forms were very carefully prepared from select, matched lumber and put together with screws and bolts. All angles were made so as to permit the forms to draw free. The inner faces of the forms were oiled and no difficulty was experienced in obtaining sharp corners and clean true surfaces. The wall was not reinforced except for the small amount of steel in the upper rail, the thickness of the wall (3 feet) making it unnecessary to reinforce the several sections or tie the panels into the pilasters except by a shallow key.

Great care was used in the preparation of the concrete facing mixture. Proportions were determined by experiment. It was found advisable to use neither the first half barrow from the mixer nor the last of the batch and by this means a very uniform concrete resulted.

The work stands as a remarkable example of the perfection possible where sufficient care is used in construction. The soft texture of the panels, the smooth sand finish of the belt course and balustrades and the sharp corners and true lines represent a grade of workmanship incompatible with low cost figures, but cost was not a consideration in this case.

The inner face of the wall was painted with an asphaltic compound, a tile drain laid at the base and cinders placed against the wall in order to drain off the surface water. While these precautions were perhaps not necessary, as the concrete was a rich mixture, yet the additional precaution against the overturning effect of frost in saturated ground will insure absolute permanence to the wall. Concrete is a material susceptible to a high degree to care in handling and the perfection of a given example of work is largely a measure of the ability of the contractor. The work was built by R. F. Wilson & Co., following the design of Ernest Mayo, Architect, both of Chicago.

CONCRETE STOREHOUSE STANDS SEVERE HEAT TEST

The fire-resisting qualities of reinforced concrete were demonstrated at the Salem, Mass., fire on June 25. The burned area was something more than 250 acres and the total loss was \$14,000,000. Practically everything in the path of the fire was swept away except a four story reinforced concrete storehouse, the property of the Naumkeag Steam Cotton Company. This building, today as good as the day it was built, presents a striking example of the fire-resisting qualities of a well built concrete building with wire-glass windows in metal frames, reinforced on the inside by tin-clad shutters dropped by automatic fusible links and equipped throughout with automatic sprinklers.

So severely were the wire-glass windows exposed to the fire that some of the glass fused and sagged out of the frames, the exposure being 5 ft. distant, directly in the path of the fire. The protection afforded by the concrete walls and fire shutters sufficed to hold the fire back, so that the heat in the building was not intense enough at any time to open any of the sprinklers, set to melt at 166° F., although some of them were within 3' of the windows. Neither was the white paint, with which the interior walls are covered, blistered. In the building were stored finished goods worth at least \$200,000. Spalling of the concrete from the heat was not noticeable except in two or three very small patches.

THE MANUFACTURE OF CEMENT DRAIN TILE PROFITABLE

The Armstrong Cement Works, Armstrong, Iowa, was organized as a stock company in 1908, with a capital stock of \$10,000, today it has a paid up capital of \$25,000. On the 27th day of March, 1910, the plant was burned down, and the company at once proceeded to rebuild. Fair dealing, careful attention to the details of the business, and the production of a first-class article in the way of products, is the cause of this success, and from a comparatively small beginning, the plant has grown until now it employs between 40 and 45 men steadily. In 1908 the average number of men employed was between 12 and 15. In 1908 the weekly pay-roll amounted to about \$250, today it is about \$700. On an average, the company uses a car-load of sand each day, and two car-loads of cement is used per week. To give an idea of the volume of business done by the company in the line of shipping, the amounts paid for freight will be interesting:

Freight paid 1908.....	\$ 2,555.65
Freight paid 1909.....	2,530.72
Freight paid 1910.....	3,664.93
Freight paid 1911.....	6,535.01
Freight paid 1912.....	5,015.95
Freight paid 1913.....	8,182.74
To October 1st. 1914.....	10,254.16

Tile has been the principal product during all these years and below we give the yearly output of the factory:

Tile made 1908.....	\$24,521.81
Tile made 1909.....	26,431.64
Tile made 1910.....	24,146.86
Tile made 1911.....	41,126.28
Tile made 1912.....	30,592.98
Tile made 1913.....	20,775.04
To October 1st. 1914.....	37,193.70

Cement blocks is another commodity furnished by the factory. The amount of cement blocks sold is:

Blocks sold 1908.....	\$ 478.13
Blocks sold 1909.....	73.21
Blocks sold 1910.....	1,385.93
Blocks sold 1911.....	549.97
Blocks sold 1912.....	1,356.82
Blocks sold 1913.....	3,852.44
To October 1st. 1914.....	2,916.74

At this time the company has a sufficient amount of work ahead to keep the plant busy for a whole year if they do not secure another job. The Armstrong Cement Works has secured some of the biggest contracts for drain tile that have ever been placed in this end of the state, and in each instance they have filled their contract to the letter and to the entire satisfaction of those interested.

"The Armstrong Cement Works," says the Armstrong Daily News, "has done more for the advancement of Armstrong, and the territory around Armstrong, than any other one thing. To them is due the credit for the city of Armstrong having electric lights today. Like in all matters about the factory, they installed the best when they put in the electric equipment, and no town in the state has better electric service than we have."

COOSA CEMENT COMPANY

The Coosa Portland Cement Company, of Ragland, Ala., has appointed T. H. Arnold general manager.

Concrete Benches for Greenhouses

At least \$5,000,000 will be spent within the next seven years in replacing the 2,200 miles of wooden elevated flower benches now used in the 11,000 greenhouses in the United States. Concrete is infinitely superior to wood for this purpose. It lasts indefinitely, without any need of white-washing, painting, or re-

lumber, the problem of making concrete flower benches would be altogether too formidable, for the forms would be complicated, the lumber would soon be racked to pieces in setting up and knocking down, and the expense would be practically prohibitive.

A far cheaper method has been developed. Adjust-



Carnations Growing on Concrete Benches.

G. Marti, Florist, Arlington, N. J. On account of the improved sanitary conditions, Mr. Marti says the production greatly exceeds the number of cuts formerly secured on wooden benches.

pairs; whereas wood, kept constantly damp—as it must be—rots so quickly that its average life in the greenhouse bench is only three to seven years. Moreover, damp and rotting wood harbors germs that are noxious to plant life; while concrete, on the other hand, provides perfect sanitation at all times, which shows itself not only in improved quality in plants and

able steel forms that will last a lifetime, especially designed for concrete bench construction, can now be obtained at small cost. Some examples of their work are shown in the accompanying illustrations. These benches are known as the “Wilson-Hoyt” concrete bench; and the forms for making them may be obtained from the Mead-Suydam Company, 371 Park



Concrete Bench in Greenhouse of Duncan C. Arnold, Florist, Babylon, L. I., N. Y.

The drainage slots, tapering from $\frac{3}{4}$ in. wide at top to $1\frac{1}{2}$ in. wide at bottom to prevent clogging, and also serving as heat conductors to overcome the natural coldness of the concrete, are a patented feature of the Wilson-Hoyt system.

flowers, but also in a greatly increased number of cuts obtainable.

Once these facts are recognized—and they are borne out by the experience of many growers who have used both wooden and concrete benches for years—it will be evident that here is the opportunity of a lifetime for the wide-awake cement man.

If it were necessary to use forms built up out of

avenue, Newark, N. J. Along with the forms, the company furnishes the necessary steel reinforcement, already cut, bent, and ready to place. The forms are simple and easy to operate with the help of the labor available at every greenhouse.

In some cases, wooden benches have to be renewed every third year, depending on the amount of water needed for cultivation of certain kinds of plants; and,

in large greenhouse ranges, there is an annual outlay for repair and rebuilding that constitutes a great burden of expense. Moreover, the cracks and fissures in wooden benches absorb germs and impurities from the earth and water, soon injuring the delicate roots of the plants and dwarfing their growth. The advantage of the concrete bench that never rots and is always sanitary, is therefore apparent.

The early attempts of some of the greenhouse men to put concrete to this use did not give favorable results, on account of the labor and cost attached to the construction of wooden forms; and when the bench was completed by this means, it did not make a very satisfactory job. Difficulty was also encountered in providing adequate drainage.

In 1906 an ingenious florist in Short Hill, N. J., developed a system of steel forms that can be adjusted to concrete legs, previously molded, making it possible to construct a monolithic bench of any desired length and any desired width. These forms, with later im-

a nation-wide campaign to bring the Wilson-Hoyt concrete bench to the attention of florists; and the steel forms for making them, to the attention of cement products manufacturers and concrete contractors. It proposes to divide this country into sixteen sections; and if it can find sixteen wide-awake and responsible concerns capable of handling the proposition, it will give exclusive territorial rights to the use of the Wilson-Hoyt bench forms.

Here, Mr. Reader, is perhaps the richest opportunity that may ever come within your reach. Will you be one of the sixteen who will be far sighted enough to grasp this opportunity while it is available? It is well worthy of your careful investigation; and if the proposition interests you at all, you ought to write at once for full particulars, to the Mead-Suydam Company, 371 Park avenue, Newark, N. J.

CONCRETE PIPE

The drainage system installed in the Fairview district, Yakima county, Washington, is of particular interest owing to the use of poured concrete pipe, in small sizes for drainage purposes. Nearly 24,000 linear feet of this pipe were made and laid in little over a month, actual working time.

The district adjoins the southeasterly corner of North Yakima, extending southward beside the Yakima river, but being separated from the river by a stretch of low-lying meadow-land, as well as some higher farmland. The district drained is free from large differences in elevation, and it is practically all subdivided into small tracts of 5 to 20 acres, intensively cultivated, planted to fruit trees, grapes, etc., and where alfalfa, grass and clover have been sown they attain a luxuriant growth, showing the fertility and ample water supply of this land. To these qualities add the ease of reaching town, and the reasons for the prevailing high land values are readily perceived.

The conditions as regards ground water found in the city itself, were found even more emphatically in the Fairview district, which is also river wash and is a little lower than the town and closer to the river, and so wet as to contain numerous swales and draws sometimes submerged in water and marked in places by growth of bulrushes or tules. Two irrigation canals and a network of laterals supply water in large quantity. The practice of using unlined ditches, and this in a gravelly soil, naturally means high seepage loss.

To relieve this condition a drainage district covering 503.5 acres has been organized, and a series of drains made of pipe from 6 inches to 16 inches in diameter has been laid.

Contract was let to the Midland Engineering Company of North Yakima, Wash., covering manufacture and laying of pipe, but neither trenching nor back-filling.

In determining the capacity of drain to be installed an estimate was made of 8 cubic feet per second flow expected from the total area. This was considered a liberal allowance of capacity, as compared with practice elsewhere based on amount of irrigation water; nevertheless a week after construction was completed the drain was already discharging about three-fourths of the amount stated. It appears that there is an underflow through the river-wash sub-soil, the quantity of which was not appreciated, and with the knowledge now gained, probably the lower end of the drain will be changed to larger pipe, perhaps 24-inch instead of 16-inch.

The pipe was made of a wet-mix concrete, with very little reinforcement, in 30-inch lengths. The pipe being practically impervious, the water is collected through the joints only. The pipes are plain



Aquatic Flowers Successfully Grown for First Time on Raised Water-Filled Benches, by Wm. Tricker, Florist, Arlington, N. J.

The bench side walls are $1\frac{1}{4}$ in. thick, and bottoms 2 in. Medusa Waterproof and Atlas cements used.

provements carried by the Wilson-Hoyt patents, have been accepted by many florists as adequately filling the results sought, because of the simplicity with which the forms are operated, reducing construction cost to a minimum, and because the unique drainage provided augments the healthful growth of the plants.

The drainage device is an interesting feature of the system. Slot openings, parallel to one another, 7 inches apart, $\frac{3}{4}$ inch wide at the top, and with sides sloping so that the opening is $1\frac{1}{2}$ inches wide at the bottom, are molded in the slab that forms the bottom of the bench.

Not only is there no possibility of clogging, but these slots also serve as heat conductors moderating the natural coldness of the concrete and helping to maintain an even temperature.

It is said that the cost of constructing the Wilson-Hoyt concrete bench is about 14 to 16 cents per square foot, or about the same as that of the ordinary bench of pecky cypress, while the best cypress benches cost 18 to 22 cents per square foot.

The Mead-Suydam Company is just embarking on

cylinders with plain butt joints, one section being laid against the next without any cement or special treatment beyond heaping some gravel over the joints before back-filling. Openings of perhaps $\frac{1}{4}$ -inch to $\frac{3}{8}$ -inch at portions of the circumference are common in the joints. Closer joints could have been made had it been considered necessary, but it was not thought best to have them too neat.

It is obvious that in the manufacture of concrete pipe for agricultural drainage the methods used require the exercise of ingenuity to attain simplification and reduction of cost. The contracting firm was able to bring to the task experience, talent and patented appliances.

In manufacturing the concrete pipes No. 22 gauge sheet steel linings were used inside and outside, being set up on a wooden plate or base-board having a wooden ring on it. The linings were made up with simple lap-joints, made by nailing them to wooden splicing-pieces. Outside the outer sheet is placed a flexible wooden form, consisting of wooden staves or lagging inside of metal bands provided with clamping device with handle at the middle of the height. This is set up with wooden distance pieces distributed around the annular opening between outer and inner sheets, and over the inner opening is placed a cover. The concrete is spaded and tamped as the pouring progresses, and the wooden distance pieces are removed to allow completion of the filling.

The only reinforcement in the pipe was formed by two hoops of No. 9 wire, each having the ends twisted together to make a rigid circle and being placed about 3 inches from an end of the pipe.

The concrete used was a wet mix, 1:2½:5, the largest particles permitted in the sand being $\frac{1}{4}$ inch, and clean sharp river gravel being used, of a size retained by $\frac{1}{4}$ -inch screen and passed by $\frac{3}{4}$ -inch screen. The maximum variation in diameter of pipe permitted by the specification was $\frac{1}{8}$ inch in any direction.

Upon finishing the pipe the wooden stave form is removed and the pipe, with the inner and outer steel linings still in place, is left for twenty-four hours to set before the removal of the steel molds. A burlap cover, kept moist by water piped from an elevated tank, prevented too rapid drying.

The mixer empties on to the wooden platform and the concrete was carried away in coal hods to the scattered molds. The latter were made in a slightly different manner from some of the others inasmuch as the base-board with ring was not used, some stones of the right thickness being put into space the steel lining plates. A man with a gauge stick went around to test the thickness setting of the molds.

It was the custom to make three different kinds of concrete, containing larger or smaller gravel in the aggregate, the finest being for 6-inch and 8-inch pipe and the coarsest for the 14-inch and 16-inch. Turns were taken in supplying the different kinds, according to the demands of the molders. H. J. Kennedy, M. E., construction engineer, North Yakima, Wash., can give further information.

ATLAS CEMENT COMPANY ISSUES NEW BONDS AND STOCK

At a special meeting of the Atlas Portland Cement Company an issue of general and refunding 6 per cent gold bonds not to exceed \$10,000,000 was authorized, and the preferred stock was increased from \$1,500,000 to \$3,000,000. The bonds are to be used only in taking up other bonds or indebtedness, in acquiring new property, or in permanent improvements. The stock will eventually be offered to stockholders at par.

REINFORCED CONCRETE FACTORY

The Nash Engineering Company, South Norwalk, Connecticut, manufacturer of air compressors and other machinery, is occupying a new factory of solid reinforced concrete, which is of unusual interest from the fact that it is home-made in all of its essential details of construction. It illustrates what can be accomplished by mechanical engineers who are untrained in concrete work, with no other assistance than that afforded by three or four local expert carpenters, equally inexperienced in the task, who made and set up the forms in the process of building, together with wholly unskilled laborers who did the heavy work. A structure 135 feet square, one story and basement, with walls and columns designed to sustain three additional stories, was completed from the foundation piers within three months from the day when pouring commenced. The cost showed a large saving from the estimates which had been submitted by contractors. The result is a massive structure, so completely proof against fire in itself and in its contents as to make insurance unnecessary.

The engineers were quick to meet the difficulties which confronted them in the beginning of their task, and various improvements in methods were evolved as the work progressed. A concrete mixer was purchased, but practically all other equipment employed on the work was designed at home, including a bending machine. This consists of a casting, bolted to a bench, having square lugs on its upper surface which form a groove to hold the rod, and a hollow lever handle carrying a hardened steel roll. The handle, lengthened by a heavy steel pipe, brings the roll against the rod with such power that the desired forming is accomplished with little manual effort. The device is also arranged to bend the double-ended hooks used to hold the reinforcing fabric in position in the forms.

The forms for molding the concrete were designed for repeated use through the various units of the building. In this work the experience gained in pattern making was of great assistance. As soon as the concrete had set sufficiently the forms were taken down and set up again in new positions. The floor forms were used at least 10 times. No lumber was destroyed, which meant a large saving in cost of labor and material as compared to the usual practice. A system of bolting together was developed, so that as a unit of the building was completed the task of removing the forms was easily accomplished by unskilled men. In fact the forms are now stored for use in the future when the additional stories shall be constructed.

In securing these results the bolts were passed through wooden blocks which served as distance pieces. They were 2 inches square, with a 1-inch hole bored through them longitudinally, which permitted the free passage of a bolt. Wooden pins were also inserted in the girder forms at regular intervals, usually three to a girder. Ordinary 1-inch dowel pins, cut to proper length, were used for the purpose. The ends of each were counter-drilled, to receive the points of nails, holes for which were drilled in the forms, which insured correct spacing. When the forms were removed the square and round wooden pieces were left imbedded in the concrete. The former give insulated surfaces for electric wiring. Their removal opens spaces of sufficient size to admit the passage of larger bodies, such as piping. The holes created by the knocking out of the round pins afford supports for hangers and trolleys, as well as for hoists, and for tackles and other permanent and temporary apparatus. The beams are of uniform depth. Therefore, wire,

pipes, shafting, trolley tracks may be run in either direction, parallel or at right angles, and in perfect alignment. Countershafting, even where unusually complex, may be put up with a minimum of planning and labor. The three countershafts of a grinding machine were set up with very little trouble.

Where the square blocks were used in the side walls they were knocked out and the holes filled by what may be called a squeeze gun, consisting of a square, box-like barrel and a plunger. Placing the muzzle against the entrance of the hole, one stroke of the plunger filled the space with concrete, and a man working outside the building smoothed off the surface on that side. To fill these holes by hand and trowel would be a long, expensive task.

The company's engineers designed special brackets to support the shaft and countershaft hangers. With the former a bracket is placed at each side of a beam and fastened in place by a bolt passing through the hole *a* and a round beam hole, and a second bolt through the hole *b*, which is below the beam. The hanger is bolted through the hole *c* in the horizontal face of the bracket.

In the countershaft bracket it is necessary to bring the lug *d* hard up against the bottom of the beam to prevent rocking. To accomplish this a taper bushing *e*, is employed, working in a taper hole. As a result the action of the bolt effects the rigid hold of the lug. A second bolt passing through the hole *f* clamps together the two opposing brackets, or a bracket and a block. It will be noticed that the clamping action of the lug is so great that a heavy weight may be applied at one end of the bracket and none at the other, without tipping.

The pouring was done in large units. For example, practically the whole upper floor of the section one was included in a single mold, comprising the walls, window space, cornice and roof. The window frames were cast solid with the concrete, securing such a solidity that the hardest gale cannot find its way in, nor are its sounds noticeable. The method employed was to hang the steel sash in the form. Planks and blocks, together with the sash edge, constituted the form for the window column, leaving open the space occupied by the sash. The concrete flowed around this space, the mold holding the sash firm in its grip.

In molding the beams and the panels between them the first step was to bolt the column forms together. These forms were used for the columns of both the basement and upper story, the required additional length being bolted on. Incidentally the forms for the walls of the basement were pieced out by bolting for the purposes of the main story. The column forms were set up on end at intervals to give a 15-foot bay, and were leveled up to the required height, 17 feet, and plumbed and braced. The bays are divided into 7½-foot panels. At each corner of the panels was set up a 4x4 inch post, having bolted to it at the top two short cross-arms at the level of the bottom of the girder forms, which they supported. The details of the method are shown on this page. The forms were placed roughly in position and were exactly lined by a block placed on top of the post, having corners scalloped to conform with the shape of the girder form. The block, with its post, was permitted to remain in place for a considerable period, until the concrete had become thoroughly hardened, but the forms were taken down after two or three days, when the concrete was still green. The ingenuity of this method will be readily seen; the post and block were not interfered with in the handling of the forms, which otherwise would have had to remain in position for many days longer.

The windows of the basement floor are protected in an unusual manner. The vertical bars are of flat steel, drilled to take the horizontal twisted reinforcement. The grating was put in after the wall was completed, the area about the inner edge of the window being left for a subsequent pouring of concrete with the bars in position.

CONCRETE SEPTIC TANKS

A New Sewage Disposal System for Country and Suburban Houses

The well-managed farm of today means many household conveniences as well as labor-saving farm machinery. Backbreaking drudgery has been largely eliminated from both house and fields. Running water and the kitchen sink and bathroom have supplanted the old-time pump and open, insanitary drainage. But the most efficient disposal of sewage remained a prob-

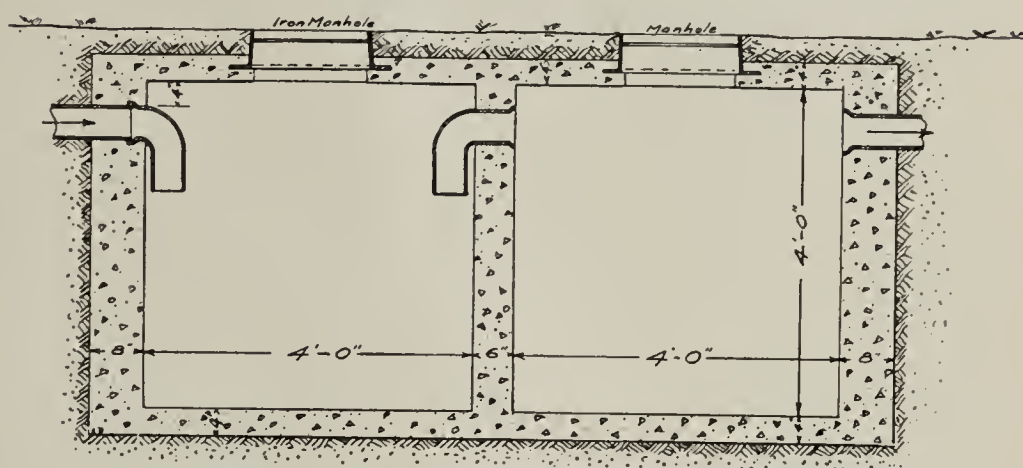


Fig. 1. Cross Section Indicating Location of Pipes.

lem until the concrete septic tank was invented. It is a simple, cheap and effective device, rapidly supplanting the drywell, with its constant menace of water pollution. In brief, there has come to the farmer his own little sewerage plant in concrete, which answers his purpose even better than large city works, for he has neither the tax nor repairs that always attach to a city sewer system.

The principle upon which the concrete septic tank operates is extremely interesting. It consists of a long, water-tight cistern, through which sewage passes

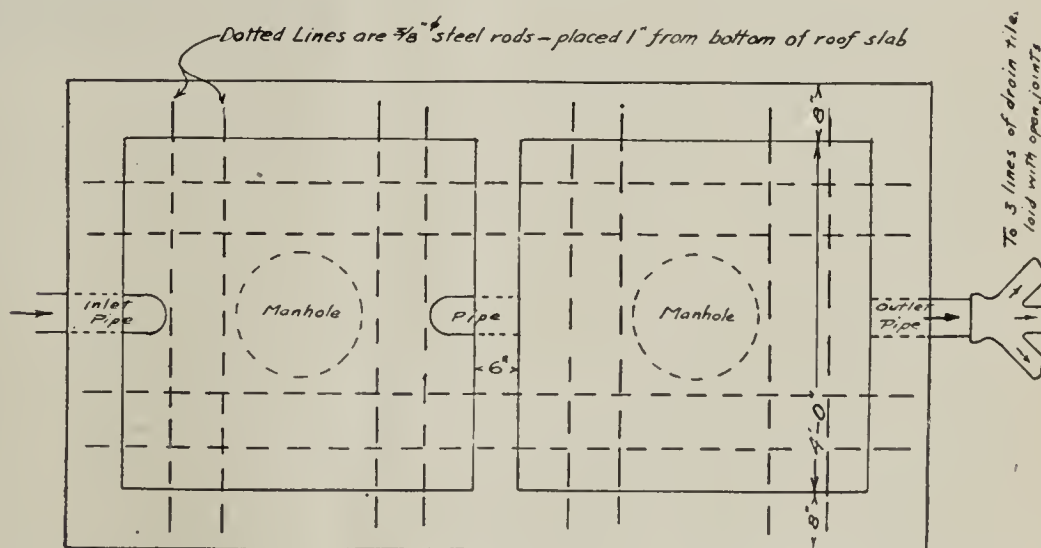


Fig. 2. Plan Showing Proper Position of Reinforcing Rods.

very slowly and evenly. Located underground, it is warm and dark, thus affording perfect conditions for the development of the bacteria or germs which clarify and render harmless the sewage. After passing through the septic tank, the sewage is practically free from all suspended matter and has the appearance of

water. From the septic tank this clear effluent is discharged into three lines of ordinary farm drain tile.

Size and Location of Tank

While the odor from a septic tank is scarcely noticeable, it is nevertheless best to locate it at some distance from the house. Choose a spot easy to excavate so that the top of the tank can be sunk 6 inches below ground level and where the lines of drain tile will have sufficient fall to carry off the discharged fluid. The tank should be large enough to hold the entire sewage for one day. For a family of eight to ten people occupying a house having two bathrooms fitted with the customary appliances in the way of tubs and stationary washstands and downstairs the kitchen sink, a concrete tank having two compartments, each 4 feet long by 4 feet wide by 4 feet high, will be required. Since the top and bottom are each 4 inches thick and the top of the tank is 6 inches below ground level, dig the pit 5 feet 2 inches in depth. The walls of the tank are 8 inches thick and the partition between the two compartments 6 inches. Therefore, the length of the pit should be 9 feet 10 inches and the width 5 feet 4 inches.

Making Forms and Placing Concrete

If the earthen walls of the pit stand firm only inside forms will be needed. These inside forms are merely boxes made of 1-inch boards. Two boxes will be required to make two compartments. The outside dimensions of the boxes should be 4 feet square by 4 feet high. The boxes or forms will be placed on the freshly laid concrete floor. Holes for taking 6-inch pipe should be made in the boxes as shown in Fig. 1. The holes should be 4 inches from the top of the box form, measuring from the top of the hole. The concrete should be mixed in the proportion of 1 part Portland cement, 2 parts sand and 4 parts crushed rock or gravel. Place a 4-inch thickness of concrete in the bottom of the pit to form the floor of the tank. On top of this concrete set the box forms, which should be ready for immediate use. Place the forms so that there is a space of 6 inches between them and an 8-inch space between them and the earthen walls of the pit. Then commence depositing the concrete for the walls and partition. As soon as the level of the concrete reaches the holes in the forms place in the holes 6-inch pipes as illustrated. Then continue the concreting until even with the top of the forms.

Reinforced Top and Manholes

Two ordinary iron manhole frames and covers may be obtained from a local dealer in building supplies. The manhole covers should fit tightly and should not be perforated. The manhole frames should be 10 inches high so that when placed on top of the forms the upper edge will be even with ground level. If the manhole frame is of less height than this, it should rest on a circular piece of 1-inch board, which is nailed to the top of the form. Since the concrete roof is to be self-supporting, it will be necessary to reinforce it with a few lengths of $\frac{3}{8}$ -inch round steel rods. There will be needed 4 pieces of $\frac{3}{8}$ -inch rods, 9 feet 6 inches long, and 8 pieces 5 feet long. The roof is now ready to be placed. Place the manhole frames in proper position on top of the form, and deposit the concrete to a depth of 1 inch and on the concrete lay the long and short bars as shown in Fig. 2. When the bars are placed, deposit the balance of the concrete so as to bring the roof to a total thickness of 4 inches. As it will be covered with earth it is not necessary to give this top surface a smooth finish, merely level the surface by striking off with a straight piece of board. The tank should now be allowed to rest undisturbed for at least 2 weeks. At the expiration of this time,

saw away wooden top of the forms inside of the manhole frames. Then enter the tank and remove the wooden forms, passing the lumber out the manhole opening. While in the tank make certain that the pipes are all unobstructed and not even partially clogged with dirt or lumber. The inlet pipe is then connected to the pipe from the house and the outlet pipe joined to three lines of 3-inch concrete drain tile. The drain tile will be laid about 12 inches below the surface of the ground and the joints left open, that is to say, no mortar must be used in the joints. This permits the discharged fluids to be absorbed by the surrounding soil. The drain tile lines should be laid in the form of the letter "Y" and sufficiently extended to cover a large area of ground. Average conditions require that each arm be about 100 feet long. After this is done, cover the tank with earth to the level of the manhole covers. It is now ready for use.

It is sometimes the custom to plant a few shrubs around the manhole openings, thus effectually hiding all evidence of the tank.

Materials Necessary

A tank of the size specified will require about 4 cubic yards of crushed rock, 2 cubic yards of sand and 7 barrels of Portland cement. There will also be needed 78 feet of $\frac{3}{8}$ -inch round steel rods, which can be obtained from the local blacksmith or hardware dealer. The tank can be built without skilled labor. It requires but few tools and construction methods are so simple that one man can easily build it.

PAINT PROTECTION FOR PORTLAND-CEMENT SURFACES

By Henry A. Gardner

In April, 1912, the writer instituted a series of tests to determine the durability of various types of paint upon Portland-cement surfaces exposed to the weather. The panels for the tests were prepared by constructing a long board wall to which was fastened expanding metal. A mixture of 1 part of Portland cement and 2 parts of clean Potomac River sand was made and applied to the expanded metal, forming a cement wall 3 in. in depth. The wall was divided into thirty-five sections or panels, each 30 in. wide and 40 in. high. Three coats of paint were applied to each panel by a practical journeyman painter. In order to make the test more severe, nearly all of the paints were applied in white. (Tinted paints are known to be much more durable than white paints.) A stripe of chrome green, 6 in. wide, was placed over the top of the third coat of paint, in order to determine whether the lime which might be present on the surface of the cement would have any effect upon the paint coating. Fading of the green to yellow would indicate such action.

The investigation had for its object the determination of what constitutes a suitable paint for the protection and decoration of exterior and interior stucco walls constructed of Portland cement and for decorating and rendering wearproof Portland-cement floors.

The tests showed that the amount of free lime in fairly dry cement surfaces does not adversely affect high-grade oil paints. The tests also showed that zinc sulphate may be used with excellent results as a primer to neutralize free lime in damp cement surfaces which are to be painted. The scaling of varnish paints, which developed in several tests, apparently showed that resinous paints are not well suited for cement surfaces.

Excellent results may be obtained by treating cement walls or floors with paints made with raw and heat-treated linseed and Chinese wood oil containing durable, wear-resisting pigments.

SILOS AND SILAGE

The Agricultural Experiment Station of the Colorado Agricultural College, Fort Collins, Colorado, has just issued a very useful and interesting booklet by H. E. Dvorachek, 6x9, containing 56 pages. It has many fine illustrations. A copy will be sent free on request. Contents are as follows: Advantage of Silage, Essentials of the Silo, Types of Silos used in Colorado, Silage Crops, Silage Making, Building Instructions for Concrete Silos, Pit Silo Construction, Feeding Silage, etc. On page 13 they have the following to say concerning the concrete silo:—

"Cement is coming to be used more and more for construction work on the farm. This is only in keeping with progress made in concrete construction along other lines. A great many objections are made to concrete as a suitable material for silo construction. Besides a number of others, the following are some of the most common: Concrete walls allow mold and decay around the walls, are affected by the acid of silage, and they cannot be built to keep them from cracking and thus leak air. These statements, of course, come from competing builders, mostly stave silo people.

The common causes of failure in concrete construction are: (1) Insufficient reinforcement, (2) dirty sand and gravel, (3) too lean a mixture or insufficient amount of cement used, (4) poor mixing of cement with sand and gravel, (5) poor placing of mixture within the building forms, (6) washing out of cement by excessive water.

Solid Wall Concrete Silo.—This type has been thus far the favorite among concrete silos, and in fact among all silos for Colorado conditions. The reason for this is that one can be built by anyone of ordinary intelligence, with unskilled labor, with but little advice or aid. Sand and gravel can be secured conveniently in most any locality at a low cost, making the cash outlay small for such construction. Because it meets all requirements of a good silo, is a permanent structure, and costs less for construction than any other type of silo suitable to this climate, unless it be the pit silo, it is to be strongly recommended. The solid wall concrete silo will give more efficient service for a dollar invested than any other above ground silo on the market today."

Polk-Genung-Polk Co., Fort Branch, Ind., manufacturers of steel forms for building solid wall con-



Concrete Tower at State Farm, Mass.

This water tower is 78 feet high, 38 feet in diameter, 20 inches thick at the base, and 12 inches at the top. The material used in the mix was 1½ parts of cement and 3 parts of sand, with an addition of 5% of hydrated lime to the cement for waterproofing. It was built under the direction of Mr. A. J. Maynard, superintendent of construction at the Massachusetts State Farm, the labor being furnished by convicts. The standpipe on the right is an iron pipe which has been strengthened by concrete reinforcements about the base.

Observations of concrete and stave silos standing side by side shows that the freezing is no greater in one than the other. By coating the walls with a wash of neat cement or tar pitch they can be made perfectly air, water and acid proof. If properly reinforced and made of suitable material they should not crack any more than does other concrete work. There have been failures in all types of silos, but it is safe to say that the percentage of failures is less in concrete silos than in most other types. That they are a success has been demonstrated beyond a doubt by those built not only in this state but other states as well. Silos of this type are known to have been used successfully for eleven years without the least sign of deterioration, or loss of silage through spoilage.

crete silos, received the following letter from E. A. Baber, Superintendent, Dayton State Hospital, Dayton, Ohio, viz:—

"The silos, which you have erected on the Dayton State Hospital Farm, I consider the most practical and ornamental structures in the agricultural district of this portion of the State. We now have them filled with ensilage and the water tank will be connected up soon.

They are especially admired by agriculturists and concrete engineers. The former for the excellent method of preserving ensilage in structures that are permanent, and the latter for the unusually smooth and true finish which the exterior of the concrete presents."

REINFORCED CONCRETE BRIDGES

By Daniel B. Luten,*

Consulting Engineer, Indianapolis.

The day of permanent bridges has arrived. It can easily be shown that it is no longer economical to build temporary bridges of wood or steel except for unusual locations and conditions. Assume for example, that a 50-foot bridge of a temporary character costs \$1,000 and that the amount be borrowed at 5 per cent interest. Assume also that the life of the bridge will be 25 years—the average life of a steel highway bridge—and that the bridge will require re-flooring at intervals of five years, and repainting at intervals of eight years.

Then for the 25 years:

Interest charge, 25 years at \$ 50.00...	\$1250.00
Reflooring four times at 100.00...	400.00
Repainting two times at 50.00...	100.00

Maintenance for 25 years.....\$1750.00

This is at the rate of \$70 per year. The original loan of \$1,000 still remains unpaid, but an additional loan of \$1,000 must be made to replace the bridge. Hence, for the next 25 years the maintenance will be increased by the interest on the second note, making \$120 a year. For the third 25 years the cost will reach \$170 a year with \$3,000 borrowed, and at the end of a century the maintenance will be \$270 a year with \$5,000 owing on notes.

If, instead, a permanent bridge has been built, all of the maintenance for the first 25 years might have been expended for interest, making a loan of \$1,400 possible at the same cost per year and this would never need be increased. That is to say, it would be economy, even for the first 25 years, to pay 40 per cent more for a permanent bridge. And, if a sinking fund were established to meet the notes at the end of each 25 years, about \$26 per year additional would be required, making the maintenance charge \$96 per year, which is the interest charge on \$1,920. So that under the above conditions a permanent bridge would be worth 92 per cent more than the temporary bridge above described.

The concrete arch is a permanent bridge that will more than meet the above comparison, and will, in fact, often compete in actual first cost with steel bridges of the same capacity. To be absolutely permanent, a bridge must be built of permanent materials and must be designed for future increase in weight and volume of traffic.

Concrete is a permanent material far more durable than stone, and increases in strength with age. A concrete arch consequently increases in strength with age since the concrete is employed largely in compression; this increase often amounts to 50 per cent in the year following the first 30 days at which time the arch usually receives its loading; and the concrete arch is the only bridge that does increase in strength with age.

This increase will usually provide for all increase in traffic not allowed for in the design.

In order that a bridge may provide satisfactorily for future increase in volume of traffic, it is necessary that the roadway supports be beneath the roadway. Thus a roadway hung between trusses or girders cannot be widened without destroying the supporting trusses, and consequently the entire bridge. In the arch bridge the support for the roadway is below, and the roadway can consequently be widened without destruction of any of the original investment except moving the railing.

*Address before Kansas Engineering Society.

The concrete bridge is frost-proof, fire-proof, rust-proof and flood-proof. The flood of March, 1913, demonstrated that concrete bridges would remain standing without serious obstruction to the flow, while the steel and wooden bridges would be carried from their supports, and then would become greater obstructions than ever to the stream. The steel or wooden truss clogs with debris while the concrete arch interposes only the narrow ribbon at the crown to obstruct debris. The haunches of the arch produce a dead water cushion at surface only, that deflects debris into the swift current under the crown. The arch may be completely submerged, as was the case with the Y bridge at Zanesville, Ohio, with scarcely a ripple on the surface to indicate its location.

Numerous improvements have been made in the design of concrete bridges in the last few years, most notable of which are the assumption that the piers are elastic and a part of the elastic arch, resulting in far lighter piers, with consequent reduction in material and increases in waterway, a doubling of efficiency; the substitution of vertical curves for camber instead of the unsightly peak as disclosed in the Kaw River bridge at Topeka, Kan.; the use of unequal spans increasing towards mid-stream, yet with uniform rise and loading, by distorting the intersection of two balancing arches on a pier so that the lesser thrust will meet the greater thrust on that side of the pier towards the greater thrust, deflecting them into the middle third of the base; drained expansion joints instead of the old tongue and groove arrangement intended to confine the seepage in the fill. Weep drains were formerly often led through the spandrels but are now carried down through the piers to discharge below the water line. And surface drains now discharge through the crowns of the arches.

There have been corresponding advances in erection methods, especially in centering, but an unfortunate tendency exists of attempting to divorce contractors from engineering skill and to require it only in the engineer. On public work particularly, it is becoming increasingly difficult to let concrete bridges to trained contractors. The ignorant bidder who can qualify with a certified check is most apt to secure the contract, and then proceeds to butcher it when he does get it.

Many engineers are ambitious to become designers of concrete bridges, and usually make the mistake of supplying ALL the engineering information in the plans and specifications, thus making it possible for anyone to bid regardless of his engineering qualifications. A much better method is to require the bidder to supply some part of the engineering requirements to qualify. Thus the engineer may file general plans showing the externals only, just as he would for a steel bridge letting, but requiring each bidder to submit the sectional structural details and to guarantee them. The specifications must then state the loading stresses and such a guarantee will be legally binding, since the bidder is called on to guarantee his own structure and not the design of another. The contract is awarded to the lowest bidder complying with the plans and specifications, and thus gives the engineer the authority to determine who is lowest bidder, since he decides whether the lowest in price can qualify as to plans.

This method of letting has another advantage, in that it provides for competition between various patented arches which have become more popular of late because they provide for stronger bridges at lower cost, the increased efficiency more than compensating the charges for royalty. A safe and durable concrete bridge can undoubtedly be erected without infringing

any patent. But it is a serious question whether a reinforced concrete arch can be erected without infringement, and it is certain that great saving can be made by the use of some patents together with greater engineering efficiency due to the assistance of the trained experts that specialize under each patent.

Invention means pushing back the boundary of science into the unknown. Scientific knowledge is becoming so vast that, except in isolated cases, none but the man trained in science may hope in future to invent. Hence the inventor of the future will be the engineer.

A patent is an agreement between the United States Government and an individual who has perfected a new and useful improvement in art or manufacture. The Government for its part of the agreement grants the right to exclude others for seventeen years from making, using or selling the patented improvement. The individual for his part gives complete publicity to the improvement in such explicit terms that anyone skilled in that particular art may be able to reproduce the improvement after the patent has expired. The reason for granting exclusive rights in the improvement is not so much a reward for originating the improvement as for giving it publicity. For every individual who originates an improvement of any kind is the owner of that improvement. If he chooses to keep his improvement a secret he may prevent others from making it for an unlimited period, provided he can maintain its secrecy from others. Were it not for patents, therefore, improvements would often be kept from public knowledge for an indefinite period.

To prevent suppression and secrecy of improved methods, the reward of the patent is offered by the government for complete disclosure of the improvement. It is for this reason that the patent consists of drawings and specifications as well as the claims, which latter are intended to define the applicant's idea of his improvement, in the most accurate language possible.

A patent is not an injurious monopoly. It withholds nothing from public use. It merely withholds for a limited time that which the owner had the right to withhold for all time. It does not even withhold anything, provided a uniform royalty is established for the patent, and such royalty has been established for each of the above patents.

In fact, under the Luten Patents the principle has been established that designing engineers will not be prosecuted for infringement except when they oppose authorized Luten Designs for their own infringing plans.

Thus, where Luten Designs do not attempt to compete there is no suit, regardless of the amount of infringement. Only one thing is necessary to avoid suit under the Luten Patents; either do not infringe, or if you will infringe, be decent about it. The reason for this principle is to secure for the Luten Designs the wide open competition that is desirable to show their superiority, and to which they should be entitled by right, but which is often denied them by engineers and contractors having inside influence. And further because the injunction is the only profitable object of an infringement suit, and damages cost too much to collect. The injunction is useful only in stopping unfair competition. The primary purpose of suits under the Luten Patents is to protect those who have recognized the merit of Luten Designs and are paying for them.

SELECTION AND USE OF CONCRETING MATERIALS AT M'KEESPORT WATER SOFTENING AND FILTRATION WORKS

The water softening and filtration plant at McKeesport, Pa., was placed in operation in October, 1908. An article on the operation of the plant was published in this journal of May 11, 1910. The present notes on the selection and use of concreting materials for this plant are taken from a very complete description of the design, construction and operation of the plant as prepared by E. C. Trax, chemical engineer of the plant, for publication in the 1913 annual report of the Board of Water and Lighting Commissioners, Mr. D. M. White, Superintendent. These notes are of interest to all who have occasion to seek watertightness in reinforced concrete construction.

The fundamental principles underlying the design of the reinforced concrete were given careful consideration from both the metal and the concrete standpoint.

Mild steel was adopted, first, because of the possible vibrations due to the operating machinery in the floor system; second, because of the probability of securing a steel of more even structure; third, because low carbon steel is more easily bent, facilitating construction.

The selection of the aggregates for the concrete was also given careful consideration, and a practice was adopted a little out of the customary. The gravel and sand used for the concrete came from the Allegheny River, and it was necessary to screen it before it was used. We required that the gravel range in size from $\frac{1}{4}$ to $2\frac{1}{2}$ in. with not more than half of it to pass a 1-in. mesh, and thus insured a more uniform mixture.

Much of the concrete used in the construction was for 6-in. floor slabs, 8-in. tank walls, and for work in general where the percentage of steel was 1.2. There was some criticism from time to time because of the adoption of the large stone, but the mixture took care of the large stone satisfactorily, without voids, due to the proper placing of the concrete around the steel reinforcement. This was watched very closely, and upon the removal of forms, the percentage of honeycomb was less than in other construction inspected from time to time where the maximum size of stone was 1 in. As this practice was more or less unusual, careful inspections were made from time to time to see that the finished concrete was satisfactory. To test for internal voids, several openings were cut through the walls, and in no instance were any found.

Satisfying ourselves in respect to the freedom from honeycombing by using larger stones, we also satisfied ourselves that this proportioning of the aggregates was the best for all practical purposes and convenience of construction. As the general practice recommends a maximum size stone averaging from 1 in. to $1\frac{1}{2}$ in., tests were therefore made to determine also whether or not the concrete was the best mixture. These tests showed that with stone of the maximum size of $2\frac{1}{4}$ in. to $2\frac{1}{2}$ in., a stronger concrete was procured than with stone of a maximum diameter of 1 in. and $1\frac{1}{2}$ in. Mechanical analyses were made of the sand and gravel, and from time to time we had to change the mixture due to the slight changes in the proportions of the constituent parts of the gravel. These tests corroborated the findings of W. B. Fuller, published in the Transactions of the Am. Soc. of C. E., in which he shows that for an equal strength of concrete with 1 in. gravel it required 17 per cent more cement than with a maximum size of $2\frac{1}{2}$ in., and that a concrete with a maximum size of $2\frac{1}{2}$ in. required 33 per cent less cement than concrete with 1 in. maximum size gravel.

As an example of the success of this method, one of the main circular walls was 24 ft. in height and 13 ins. thick, reinforced with $\frac{3}{4}$ in. rods both horizontal and

vertical. An approximate 1:3:5 mixture was used. It was deposited from the top and fell the entire height. Upon the removing of the forms, no honeycomb surfaces were found. The concrete was mixed quite wet, using as much water as it would hold and great care was taken not to give it an excessive tamping.

Proper consideration was given to the matter of building forms. To build the forms part way up and deposit the concrete at different intervals in the height, required a costly building and changing of runways. It also made it absolutely necessary to have a horizontal joint in the concrete whenever the runway was changed. Horizontal joints should be avoided wherever possible; when vertical joints are used keys should be placed in the forms. In no instance did the vertical joints give any trouble whatever. In the few instances where horizontal joints were necessary, great care was taken to wash the old concrete surface thoroughly clean before the placement of fresh concrete. Even after taking this precaution, however, some leakage was found in the horizontal joints. It was finally decided in all instances to build the forms continuous from top to bottom and to place all concrete in the section of the wall so that a complete vertical section could be finished in one day's work. By taking great care in the proper placing and tamping of the concrete, we obtained a wall of quite even texture which gave good results when subjected to the pressure even of clear water.

The method of tamping the concrete was a little contrary to ordinary practice. At first the spade method was used by inserting a sheet of steel about $\frac{1}{4}$ in. thick between the concrete and the form. This gave a finished surface which did not have any honeycomb, but invariably gave a surface showing a sand deposit which could readily be rubbed off. This form of tamping was finally abandoned and wooden tampers were used with an iron shoe on the end 1x6 ins., and instead of inserting this tamper between the concrete and forms the concrete was pushed against the forms. This prevented the separation of the cement from the sand, and upon the removal of the forms the concrete gave a harder, more metallic appearance. In concluding to construct the forms so as to permit the depositing of concrete from top to bottom in one operation, a question presented itself, whether or not it would be better to build the forms in one piece or in sections. As before stated, the section scheme was finally adopted. The sections averaged 6 ft. high and 8 ft. long. The ribs were cut off to the radii, and the lagging placed on always in a vertical direction; in a few instances the lagging was placed on horizontally or bent to the curvature of the form, but the results were quite unsatisfactory; the tendency to become straight pulled the section out of its true curvature.

The concrete throughout the structure varies in classification and includes groined and plain arches, retaining walls, tanks, cantilever constructions, columns, beams, and floor slabs.

CONCRETE FENCE POSTS

Concrete fence posts are used for so many purposes that you are losing money by not making them, declares the W. E. Dunn Manufacturing Company, 4139 Fillmore street, Chicago. Dunn Molds make the strongest posts at the least expense and in the least time. The vibratory base eliminates air and water pockets and saves tamping. Permits from 4 to 100 posts to be made at one time. Furnished in batteries of four and ten molds. Price of 4-mold battery, \$12.50—on 15 days' trial. Ask for the Fence Post Catalog.

PROPORTIONING OF CONCRETE

In correctly made concrete the amount of sand should be just sufficient to fill the voids in the coarse material, and the amount of cement just sufficient to fill the voids in the mixture of sand and coarse material and to coat all the particles with very thin jointing layers. It is a rational assumption that such concrete will give a maximum of strength with the minimum of cost, and if such assumption be justified by experimental results it follows at once that the proportioning of concrete-forming materials is of the utmost importance. Greater strengths can be obtained by the use of excess of cement, as in the case of the ordinary mix of 1:2:4, but the increase in strength is less than the increase of cost of materials and is, therefore, only justified in particular cases.

The strength of any concrete will depend not only upon the materials and their proportions, but also upon the method of using those materials. Any void in a mass of $\frac{3}{4}$ -inch coarse material may be filled in many ways. Firstly, it may be filled with cement and sand mortar, as in the 1:2:4 concrete; secondly, it may be filled with a piece of stone which practically fills the whole space; and thirdly, it may be filled with a number of stones which vary in size with a minimum amount of cement and sand mortar. The best filling is composed almost wholly of joints, and on that account is weak; the second filling is strong, owing to the absence of joints, but it is impracticable; but the third is a compromise which is not only practicable but also strong. It will be seen that the amount of the variations in size or the grading will depend upon the nature and quality of the work required. On the one hand there will be good but costly filling and on the other a cheap but still good filling, whether the gradation be large or small the filling will be better than one of cement and sand mortar only.

With a view to testing the effect of "proportioning" upon the strength and other properties, and also the cost of concrete, John A. Davenport and Prof. S. W. Perrott, of the civil engineering department of Liverpool University, drew up a series of experiments, the intention being to test compressive strength, modulus of rupture, specific gravity, water resistance, and fire resistance. Various difficulties arose in the course of the work which prevented the inclusion of specific gravity, water resistance and fire resistance tests. The results were contained in a paper recently presented by them at a meeting of The Concrete Institute, and entitled "Sand and Coarse Material and Proportioning Concrete."

The series involve 216 test pieces, to which must be added others prepared for water and fire resistance and specific gravity tests, but which could not be tested in the time available. The voids were measured in a patent apparatus designed by Mr. Davenport, which gives results of 1-5 of 1 per cent; and which was found to be independent of the observer. The preliminary data comprised tests on Portland cement, size of granite chips, volume of chips per batch, percentage volume of voids in chips, sizes of river-sand used, volume of sand used per batch, percentage volume of voids in sand, and the volume of cement used per batch. Regarding the latter item it must be noted that no allowance was made for the excess cement required for jointing, only the amount required to fill the voids being used. Had time permitted it, the correct allowance in each case would have been ascertained and additional tests made therewith. The limited time made it impossible to test the cement before using it for the concrete test pieces,

the brand only suggesting its probable good qualities.

The batches were hand-mixed by engineering students and as no special means of testing the thoroughness of the mix were adopted, the resulting concrete will probably not compare favorably with machine-mixed concrete so far as uniformity of results go. Every care was exercised, however, in mixing to get all the materials thoroughly intermixed and apparently uniform. This proved to be the case when the specimens were tested. The molds were made of planed boards, bolted together with gangs, damped before using, and lined with paper on the under side to facilitate removal. In spite of this, several pieces were damaged in removal, due more particularly to the relatively small sections used.

Immediately after mixing, the molds were filled and left in a tool shed till required for testing. They were wetted regularly every three or four days.

It was found that the ratio of compressive to tensile strength varied more in the one-month than in the three-month tests, and is not sufficiently uniform to base any conclusions upon, beyond the fact that such

only be further considered. Of course, the total cost is always the final criterion as regards economy, and it may be suggested that the ratio cost of cement to total cost need not be considered. But the relative values of total cost obtained may be altered when additional tests are made at other ages, and it is difficult to say whether they will be affected by the ratio, so that if it can be shown conclusively that this ratio is constant or nearly so, the total cost, age and proportions need only be dealt with.

ADVANTAGES OF CEMENT DRAIN TILE.

In every locality where it has been introduced cement drain tile has replaced the clay article. Cities, townships, farmers and others are quick to grasp the advantages of cement tile, and will demand it when they have once tried it.

The laying of the tile costs more than the mere price of the tile; therefore, if an article can be secured which does not have to be replaced, but will last and



H. H. Hart Residence, Claremont, California. Medusa White Portland Used for Exterior Finish.

Bickey & Reed, Architects.

ratio is not constant. It is considered by the authors, however, that this ratio should be more or less constant as the failure, whether compressive or tensile, depends upon the adhesive strength of the cement.

The ratios of strength at three months to strength at one month were more or less uniform, more particularly in the case of comparative strengths. In the case of 1:2:4 concrete the modulus of rupture appears to increase more rapidly than the compressive strength, while in the other series with cement accurately proportioned, the compressive strength increases more rapidly than the modulus of rupture, as out of six series only one runs the other way, probably due to rather dry mixing of those three-month test pieces.

Although the cement tests are unsatisfactory, it will be possible to compare the strengths and costs of the concrete in the different series, as they will probably all be affected to the same extent. The most important point brought out by such comparison is the fact that for accurate proportions, the ratio of cost of cement to total cost is practically constant for all gradings taken in the tests, so that when the graded coarse material is used the total cost need

grow stronger as long as the soil remains, it is a big saving both for present and future generations.

Cement tile is in existence which was built thousands of years ago, and is in better condition today than ever.

This is a final and convincing answer to every requirement.

Clay tile is decomposed, and stone goes to pieces in time, necessitating constant replacements. Cement pipe is indestructible.

The aqueducts of the city of Rome, built in early days, and the concrete water pools which still furnish water to the city of Jerusalem, although they were built by King Solomon, still bear witness to the fact that concrete for water conduits or sewers will last for ages.

1—Clay tile finally rots and goes to pieces. The very elements that destroy the clay or other materials in this way make cement tile stronger and better. The older, the stronger. The more moisture, the better.

2—Cement drain tile, if made of correct materials, absorb more water than clay, as they take in water the whole length.

3—Cement tile will stand more frost and more handling and shipping than clay tile. Therefore, no loss from breakage.

4—They are more easy to lay, as they are perfectly straight, both inside and out, and the ends are square and smooth. They do not swell up and break.

5—Cement tile drain wider and quicker. Ground can be worked quicker and less ditches are required.

Benefits from Draining Land.

Drainage is the most profitable investment a farmer can make. It will yield a high rate of interest on the money invested. Experience has shown that at a low estimate for wheat fields, drainage will increase the yield from 15 to 25 per cent at the least.

It will lengthen your season by making it possible to plow the drained land earlier. It prevents much surface washing. Drained land is lighter to work and the quality of the crop is improved. Drainage insures certainty of crop. The farmer who cultivates drained land can break it a week earlier in the spring. The soil is loose and pliable; he can plant fully ten days earlier with the certainty that if the seed is good it will germinate. He can cultivate much earlier and with much

RAPID CONCRETE BRIDGE CONSTRUCTION

The union street bridge at Danville, Va., is 1,060 feet long, 22-foot roadway. It contains about 160 tons of steel, round bars, and 3,000 cubic yards of concrete. The foundations are on solid rock and all shallow, as river currents prevented any dirt from lodging.

The design was furnished by Wilbur J. Watson, Cleveland, Ohio, and two ribs carry the floor system which is 14 inches thick without paving, that to be put on whenever the concrete floor wears enough to warrant it.

There was an old wooden bridge there and that was torn out as the new one was built, tearing out one span at a time and using the old bridge to carry the concrete to the new span, and using the old timbers for false work to hold up the concrete. There are thirteen 80-foot arches. The third arch was 90 per cent complete when a defective timber in the bracing gave way and the span fell into the river. Despite that the structure was finished sixty-five days ahead of contract time and opened to traffic thirty-five days ahead, as forms had to stay in thirty days.



Reinforced Concrete Bridge on Union Street, Danville, Va.

less labor. The soil can be stirred 24 hours after a heavy rainfall.

A wet season has no terrors; a dry season is much more productive.

Thousands of acres of fine land, otherwise useless, is being reclaimed yearly by drainage; therefore the increasing demand for drain tile, and there are sure returns from putting in a machine. Write the W. E. Dunn Mfg. Co., 4139 Fillmore street, Chicago, to-day for their new catalog, illustrating and describing their machine for making cement drain tile.

GONDOLA CAR UNLOADER

An outfit for unloading sand, stone, gravel or coal from gondola cars has recently been put on the market by the Link-Belt Company, of Philadelphia, Chicago and Indianapolis. It is either stationary or portable and enables from two to three men to unload a car at the rate of 50 tons per hour. It is claimed that the cost of unloading is 1½ cents per ton against 8 or 10 cents for hand labor.

Two elevators do the work. The first is carried on a steel frame, hung on the end of a boom which may be lowered and raised in and out of the car by means of a wire rope and winch. The material, fed to the buckets by shovellers in the car, is delivered by means of a steel spout to the second elevator, which fills the bin. The advantages claimed for using two elevators are that it decreases the weight of the hinged part, and that the material may, if necessary, be spread on the ground at each side of the pocket as a reserve storage.

The old bridge was quite an advantage in the construction, and a dry summer was another advantage. Work was carried on night and day. A ½-yard mixer, two side dump cars and two mules included all the plant used.

Stone was shipped twenty miles; sand was taken from the river nearby; Old Dominion cement used; steel was furnished by the Carnegie Steel Company.

Danville is the largest loose-leaf tobacco market in the country, and a large part of the tobacco comes in by wagon over this bridge, and it was very important to get the structure finished between seasons. That result was easily accomplished, the construction requiring a little less than four months.

There have been two floods since completion of the bridge, one seventeen feet and the other fourteen feet, coming to those heights in less than ten hours, writes Thomas Sheahan, contractor, Richmond, Va.

CONCRETE BRIDGE AT CHATTANOOGA

Contracts have been awarded for a reinforced concrete bridge over the Tennessee river at Market street, Chattanooga, Tenn. The contract for the steel work (Scherzer type Bascule) was let to the Toledo Bridge and Crane Company, Toledo, Ohio, and the contract for the masonry to the Vang Construction Company of Cumberland, Md., who agree to finish the bridge in 360 days.

B. H. Davis, New York, is consulting engineer, and Ellis Soper, Chattanooga, is constructing engineer.

TWELVE MILES OF CONCRETE PIPE LAYING

A 12-mile conduit of 36-inch concrete pipe has been built down the canyon of the Middle Boulder Creek on the east slope of the Rocky Mountains in northeastern Colorado, as a part of the hydro-electric development of the Eastern Colorado Power Company. A high, cyclopean, concrete masonry dam across the stream at Barker's Meadows, 17 miles west of Boulder and at an elevation of 8,000 feet above the sea, will form a large reservoir for impounding water. The 36-inch pipe line extends from the dam, down one side of the canyon, to a power station which is under construction 4 miles west of Boulder. The conduit is on a hydraulic grade line having a fall, approximately, of 26 feet to the mile, while the creek drops very rapidly between the dam and the power house. As a result, the pipe line is at an increasing height above the stream, the difference in elevation between its lower end and the power house being nearly 2,000 feet.

In almost the entire distance covered by the pipe line the canyon of the creek is quite narrow, with sides formed of very steep hills and abrupt, precipitous, rocky cliffs. The conduit is in a bench that has been cut in the right-hand side of the canyon, starting at a height of about 40 feet, above the bed of the stream at the dam. From the latter the location of the cut gradually rises on the face of the hills and cliffs until it is soon several feet higher than the creek. It then continues along at still greater heights, reaching finally almost to the top of the mountain that borders the canyon at the power house. This bold location, high above the bed of the stream, and the transportation difficulties involved, made the construction of the conduit so difficult as to border on the spectacular.

The trench for the pipe was made 4 feet wide on the bottom, with such side slopes as the material would take. The depth of the trench was kept sufficient to permit a minimum cover of 30 inches to be placed over the pipe as a protection to the latter from frost. The location of the line along the face of the steep hills required long stretches of heavy cutting under most difficult conditions. Seven tunnels, having a total length of 1,500 feet, also were necessary to pass through the rocky hills, jutting out here and there into the canyon in such manner that it was impracticable to cut a bench along their faces. A large percentage of the excavation was through solid rock, while loose rock and boulders were encountered in most of the balance of it. The trench in the greater part of its length is so high above the bed of the stream, and the face of the hills along which it passes is so abrupt, that the employment of machinery in making the excavation was feasible at only a few points. As a result, holes for blasting were drilled, and the rock removed by hand.

Where the conduit is on the hydraulic grade line, 36-inch concrete pipe having a 3-inch shell is employed. A number of inverted siphons are required to cross the gulches and draws leading into the canyon. Most of these breaks in the side of the latter are on steep slopes with abrupt faces of rock. For heads up to 45 pounds per square inch on siphons, reinforced concrete pipe is used, and where that pressure is extended the siphons are of steel pipe. The total length of the various siphons, however, is only a small percentage of the length of the conduit.

The 3-inch shell of the pipe laid on the hydraulic grade consists of 1 part Portland cement and 3 parts aggregate, graded from sand to stones having a maximum dimension of 1 inch. This pipe was cast in sections 2 feet long, with socket on one end and a bevel on the other end of each section to form the

joints. Each section contains two hoops of No. 5 steel wire of high tensile strength, one hoop being placed 6 inches from each end. These hoops are not considered to be of much value as reinforcing, but aided in preventing breakage before the concrete had set.

The line of the conduit is very crooked, the longest tangent not exceeding 500 feet. Straight and beveled pipe were employed together to build the conduit on curves. The latter were located so that their radii were as nearly uniform as possible, requiring only two kinds of beveled pipe. The contract for making, transporting and laying the 12 miles of concrete pipe in the portion of the conduit on the hydraulic grade was awarded to Mr. Arthur Bent, of Los Angeles, California. The reinforced concrete siphons were built by the Reinforced Concrete Pipe Company, of Los Angeles, under the patents of the Reinforced Concrete Pipe Company of Jackson, Michigan.

From these points all such materials had to be hauled by teams along a road in the canyon. In order to reduce to a minimum the distance which the completed pipe had to be transported, seven pipe-casting camps were located at intervals along the line at sites where rock or gravel was available, and where an opportunity for delivery of the pipe sections to the trench was presented. These camps were on level areas that occur occasionally in the bottom of the canyon, thus insuring an ample supply of water from the stream. The difficulty of raising sections of pipe to the trench might have been reduced, where the line of the conduit reaches a great height above the bottom of the canyon, by locating the camps on the sides of the gulches leading out of the latter. The large quantity of water required in casting and curing the pipe, however, could not be secured at such sites.

At two of the casting camps, satisfactory gravel for concrete was obtained from the stream bed; while at the remaining five, rock quarried from the mountain sides was employed as the aggregate. Both the gravel and the rock were passed through a crusher before being used. In all of the work it was necessary to produce most of the fine material from the crushers, since good sand did not occur in the vicinity of the camps. The crusher output was screened, and the supply of materials manipulated carefully, to insure the proper proportions of the different sized aggregates.

The pipes were made in steel molds consisting of a bottom-supporting ring, an inner core, and an outer shell, all of which were of such dimensions and construction as to insure pipe sections of accurate size and shape. The supporting ring was of cast iron, with an inner diameter of 36 inches and an outer diameter of 42 inches, while its cross-section was such as to give a surface that formed the socket end of the section. The core and outer shell of the form were each of a single $\frac{1}{4}$ -inch steel plate.

Two men worked at each set of forms, one of them shoveling the concrete and the other tamping it with a 23-pound iron tool. The men on each form alternated in tamping and shoveling, since the former was much the harder work. The concrete was placed in 3-inch layers, each of which was thoroughly tamped before more concrete was added. The mixture was made of such consistency that water appeared on the surface under the hard tamping to which the sections were subject. With this mixture it was found impossible to remove the forms immediately without damaging the fresh pipe section. At the same time the resulting concrete was such that by keeping it thoroughly wet for 7 days amply strong pipe was produced.

When a form was filled the flaring guide ring was removed, leaving about 4 inches of concrete at the top, held in place only by the core. The two men next took a second cast-iron ring similar to the supporting ring of the form, and tamped this concrete at the top thoroughly, thus making the bevel of the pipe section true to size and shape. With the section of the pipe thus completed, the inner core was collapsed slightly so that it could be withdrawn by means of handles on it. The core was then moved to the next supporting ring, and set up with a second outer shell, two of the latter being provided for each two men. One of these shells was thus allowed to remain around a pipe section until a second section had been cast. It was then removed to be used again, leaving the section unsupported except for the ring at the bottom. No difficulty was experienced, however, from distortion or cracking of the sections.

The casting and placing of the entire pipe line was accomplished in $4\frac{1}{2}$ months. In this work alone, 150 to 200 men were employed, 20 skilled pipe-makers being brought from California. Late in September, when the work was approaching completion, a week of freezing weather occurred. Pipe making was continued without delay during this period, and, by the use of smudge fires in the casting yards at night and careful thawing with water during the day, no pipes were damaged.

ROLLER BEARINGS IN RING-ROLL MILLS

By L. H. Sturtevant.

In cement plants the bearings of the clinker pulverizing machinery work under heavy pressures and most trying conditions. Enveloped in clouds of cutting dust and dirt, operating continuously twenty-four hours a day by three shifts of cheap labor, and often required to work on extremely hot clinker, probably no other bearings are subject to so severe a test.

This necessitates bearing constructions of the highest grade, with a perfect lubricating system and enough reserve oil supply to allow for neglect.

It is admitted that if a bearing is not given sufficient oil, or if this oil does not properly circulate, there is only one result—bearing destruction.

The average bearing working under heavy pressures does well if it can keep going under these adverse circumstances of dust and dirt; but when hot clinker is added to these conditions, and the machines are operated day and night by a series of careless laborers, it is only the very best roller bearing that can be depended on.

To meet such conditions the Sturtevant Mill Company began the construction of its special roller designs. Two years ago they were placed in mills doing the heaviest work—and soon many were in operation—and at the present time only roller bearings are ever offered to customers working difficult propositions. **Not one has ever given trouble**—every user is a satisfied friend.

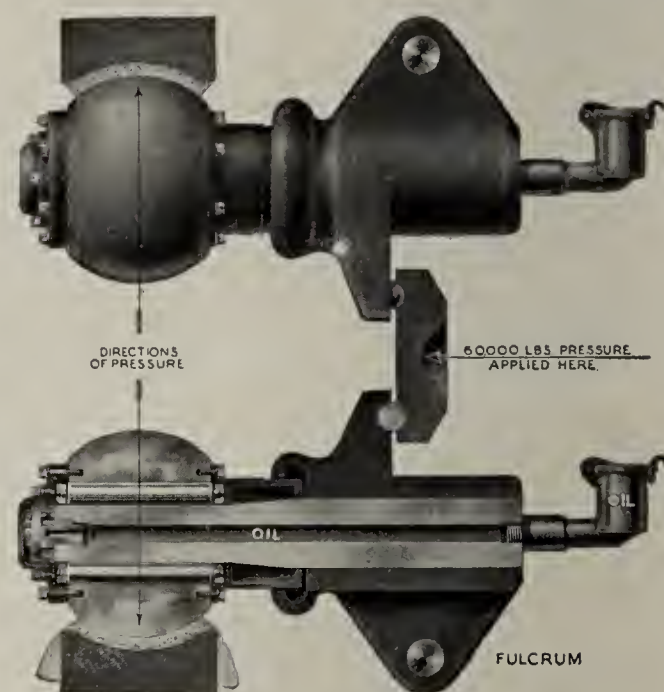
This roller bearing is the greatest improvement ever added to day and night mills—because it ensures reliability and establishes that heavy duty, dust-proof, fool-proof construction dear to every manufacturer.

We have not called attention to the **easy running** of a machine that is equipped with roller bearings. This is not doubted by anybody. An automobile owner who believes in plain bearings should be a rare bird—and a manufacturer who has ever run a

mill with Sturtevant bearings and who does not know that he is saving power and attaining the most perfect bearings results it is equally difficult to discover.

The oiling system of Sturtevant bearings is almost as important as the bearing itself. The oil is protected from dust, the bearing is also protected from dust—and although it is expensive in first cost, no other large, heavy duty machine runs with so little attention or expense. No mill user can afford to be without it.

It holds several quarts of oil and a reserve supply is held in the big oil cup.



Everything has been done to produce the perfect heavy duty bearing, and here it is! Large rollers, 2 inches in diameter, and carefully hardened, run on a hardened shaft of special steel. The latter is **stationary**—the hardened crushing roll shell revolves on these rollers around this shaft. The roll shell is the wearing part that grinds the cement clinker, and is carefully ground on the inside, which forms the outer race of the roller bearing. A dust-excluding cap closes the outer end of the bearing and is fastened to the end of the roll shell. This cap also serves as a support for the end thrust bearing.

This is a simple and effective design which has been in operation for more than two years under constant, severe tests, and in numerous plants, and has everywhere made good. Not one has ever broken and no part has yet been replaced.

It has the following advantages over plain bearings:

It is a great power saver.

It saves much oil.

It will not heat or stick under any conditions if well lubricated.

It is dust and fool-proof.

Every part is thoroughly accessible.

It can be placed in any old Sturtevant mill without changes of any other part.

These bearings are now found in all new Ring-Roll Mills. No others are supplied unless especially requested.

STONE QUARRIES

The Hobrane Stone Company of Maple Grove, Ohio, uses a 70-C Bucyrus steam shovel for loading the crushed stone into dump cars.

Dolese & Shepard Crushed Stone Company, who have a quarry near Chicago, operate a Bucyrus steam shovel.

PLANT OF THE COLUMBIA QUARRY COMPANY

The Columbia Quarry Company's plant is situated in Illinois, about fourteen miles southeast of St. Louis on the Mobile and Ohio Railroad. This plant is an excellent example of a good sized, up-to-date crushing plant. It has an output of 3,000 tons of crushed rock per day. This rock is a hard limestone of very good quality, especially well adapted for railroad ballast, county road work, concrete and fluxing.

The quarry is 1500 feet in length with a face of about 75 feet. The rock is loaded by two Bucyrus shovels, a 100-C and a 70-ton. The former is fitted with a $3\frac{1}{2}$ yard dipper and the latter with one of $2\frac{1}{2}$ yards capacity. The combined capacity of these machines averages 3,000 tons of blasted material per day. The stripping, which consists of 6 feet of sandy clay is handled by a 30-ton revolving shovel which

The rock is crushed by a No. 12K. Gates type gyratory crusher, built by the Allis-Chalmers Manufacturing Company of Milwaukee. It is then elevated by a No. 12 Allis-Chalmers elevator, passing over a 60 in. x 20 ft. revolving screen, where everything from $2\frac{3}{4}$ inches down is screened out. Stone over this size passes over this screen by gravity to a No. 8K Gates crusher where it is recrushed. This stone is then elevated by a No. 8 bucket elevator and is screened over two 48 in. x 24 ft. screens, making 2-inch, $1\frac{1}{2}$ -inch, 1-inch, $\frac{1}{2}$ -inch stone and dust. Any stone over 2 inches in size from these two screens is carried by a belt conveyor to the bins directly over two No. 5 crushers, where it is recrushed. This stone passes directly to the No. 8 bucket elevator, where it again is carried to the two 24 ft. x 48 in. screens. The No. 3 crusher is used to re-crush 2-inch stone where more fine stone is needed. All crushers, screens, elevators



View of Quarry of the Columbia Quarry Company.

Bucyrus shovels, Cyclone drills, Western $1\frac{1}{2}$ -yard dump cars and Gates crushers are used by this company.

loads into a $1\frac{1}{2}$ yard Western side-dump cars, manufactured by Western Wheeled Scraper Co., Aurora, Ill. About 400 cubic yards a day is taken away.

The face of rock runs between 70 and 75 feet in height. This is drilled by two No. 14 Cyclone drills, which are operated by 10 horse-power Allis-Chalmers motors. A smaller drill of the same make has been used, but this is soon to be moved to another quarry operated by this company. The Cyclone drills are giving good service and the company is well pleased with them.

The No. 14 drills drill the full depth of the face from 8 to 10 feet apart and about 25 feet from the face. From 50,000 to 100,000 tons is shot down in a blast, 40 per cent nitro-glycerine dynamite is used. It is intended to plan the work in the near future, so that 350,000 tons is blasted at a time. Pieces of rock too large to be handled by the shovels are subsequently worked with jack-hammer drills and re-blasted.

The shovels load into 5-yard, side-dump cars, which are hauled in trains of from six to ten cars each by a 16-ton Porter locomotive to the foot of the incline, up which they are hoisted by cable.

and hoists are of the Allis-Chalmers Manufacturing Company's make. All machinery with the exception of the three steam shovels and locomotives are operated by Allis-Chalmers 25 cycle, 3 phase, 440 volt motors.

The plant is equipped with one 150, one 100, one 75, two 60, one 40, three 30, one 20, two 10 and two 5-horsepower motors. There also are in the plant two vibrating screens manufactured by the Jeffrey Mfg. Company used to re-screen the $\frac{1}{2}$ -inch rock. The crushing capacity is over 3,000 tons per day.

The finished product is fed into railroad cars where it is either shipped out or stored in storage piles. The quarry has lately been equipped with a 30-ton locomotive crane with clamshell attachment. This locomotive crane does a great deal of switching of the cars and handles the rock to and from the various storage piles. It is always the aim to carry a large supply of all sizes of stone in the storage piles, so as to be able to take care of any sudden demand.

The plant is in charge of Cris Hosted, general superintendent, Columbia, Ill. The office of the company is in the Fullerton Building, St. Louis, Mo.

PUDDLING OR RAMMING AFTER PLACING

When concrete first came into use, dry mixtures were used almost exclusively, and in order to obtain compact and dense concrete considerable tamping was necessary. Times have changed, however, and nowadays nearly all concrete mixed for placing in forms, except that placed under the direction of students of the "old school," is mixed wet, and ramming or tamping dispensed with entirely, the mixture being churned or puddled just enough to remove the entrained air.

Still we occasionally hear of some superintendent, inspector or engineer in charge of construction work demanding that concrete, even if it is wet, be placed in 6-inch layers and thoroughly tamped. With such concrete, tamping defeats its very purpose, for the top will be flooded with water mixed with pure cement, thus robbing the concrete of cement and reducing its strength, and making the concrete of a non-uniform mixture by forcing the large aggregate to the bottom. A wet mixture of concrete such as can be spouted by gravity should never be tamped or rammed with heavy tools; stirring, spading or puddling with forks, spades or rods is all that is required to allow the entrained air to escape and the voids to be filled. When wet concrete is used, it is also very important to see that the concrete be placed or poured in such a way as to prevent the formation of air pockets, thus reducing the puddling or spading necessary.

Even with "dry" concrete there are dangers to be incurred by "too much tamping"—that is, by forcing the stone to the bottom and weakening the concrete by disturbing it after settling has begun. As in most work, there is a happy medium which must be struck in order to obtain the best results in ramming or puddling concrete.

When wet concrete is used, the rate of progress of the work is much more rapid than when dry concrete is used, since it can be placed in thicker layers and requires less attention in the matter of puddling if carefully placed. Wet concrete, then, it can be said, is the result of the general tendency toward the use of more economical methods in concrete construction work.—*Railway Engineering.*

KEENAN LIME CO.

The Keenan Lime company, Smiths Basin, N. Y., is burning about 300 barrels of lime per day, which is about one-half the usual output. Only four kilns are being operated. This company has the reputation of never having discharged an employee if competent men are engaged. If business becomes slack and there is a lack of work at the plant the men are put to work in the quarries in getting out stock, which must be allowed to season for several months before being incinerated, or they are kept busy on the company farms near by. This company, by the way, owns some of the best farming property in Washington county, its farms being very productive.

FIRES BIG BLAST

Approximately 80,000 tons of rock were dislodged with a charge of three and a quarter tons of dynamite at the immense quarry of Strunk & Hartman, at Limekiln, Pa., recently. A Clipper drill was used in the blast. Much credit for this is due to the expert work of T. F. McDevit, of Allentown, Pa., who drilled the holes, 38 in number, requiring two months to complete the work. The total cost of the blast was \$1,700, but it will keep the quarry active for a year. The holes vary in depth from 28 to 5 feet. The dynamite used was two tons of 60 per cent and the balance of 40 per cent, manufactured by the Atlas Powder Company.

The crusher of the company is operated by electricity. Five grades of spalls are made and shipped to various points in Berks county. Concreters, macadamizers and the Reading Transit Trust Co. use up the greater amount. This firm supplies about one-half the spalls used in the city of Reading. An extra shift will be run from now on to get out the orders already booked. There will be ten men to a shift. They load their dump cars with a "Theu" steam shovel which gives good service.

At present the firm employs 17 men, with which force 300 tons of spalls are turned out daily.

The firm consists of Samuel H. Strunk, of Limekiln, Pa., and Ezra G. Hartman, of Reading. They have been in business for almost five years. The plant is valued at \$24,000.

CONNECTING UP THE BLAST

It seems almost incredible that in this enlightened age one could find a blaster connecting wires from one hole to another by looping them, and yet this was seen only last summer, and the blaster was one employed by one of the biggest contracting companies in New England. His method was to twist a loop on the end of each wire and loop the adjoining wire to that. Perhaps the most remarkable thing about this whole performance was the fact that occasionally he succeeded in firing a blast. He complained that a great many of the electric blasting caps misfired and were no good. By the aid of the galvanometer it was easy to demonstrate, even to his primitive mind, that there was something wrong in his method of connecting; that when the loops were tight between holes the current could be sent through the wire, but when the loops were loose there was very often a condition where the wires were not touching each other at all, and, of course, no current could pass.

A second instance of trouble due to imperfect connections of wires was in a mine where the atmosphere and gases caused rapid corrosion of the copper. It was the practice in this mine to delay firing a blast for some time after it was loaded. The corrosion was so rapid that frequently a blasting circuit would show no deflection when tested with galvanometer when the blaster was ready to fire.

A number of blasters who are conscientious about securing good, clean and tight-twisted connections of the wires of the electric blasting caps pay no attention to the tightness of the connections of the leading wire itself and of the leading wire with the electric blasting cap wires. The leading wire is very often cut and broken in a blast; in fact, it is rather exceptional when it is not, and in a short time after it is twisted together the connection becomes so loose that misfires are likely.

The proper way to make a connection is as follows:

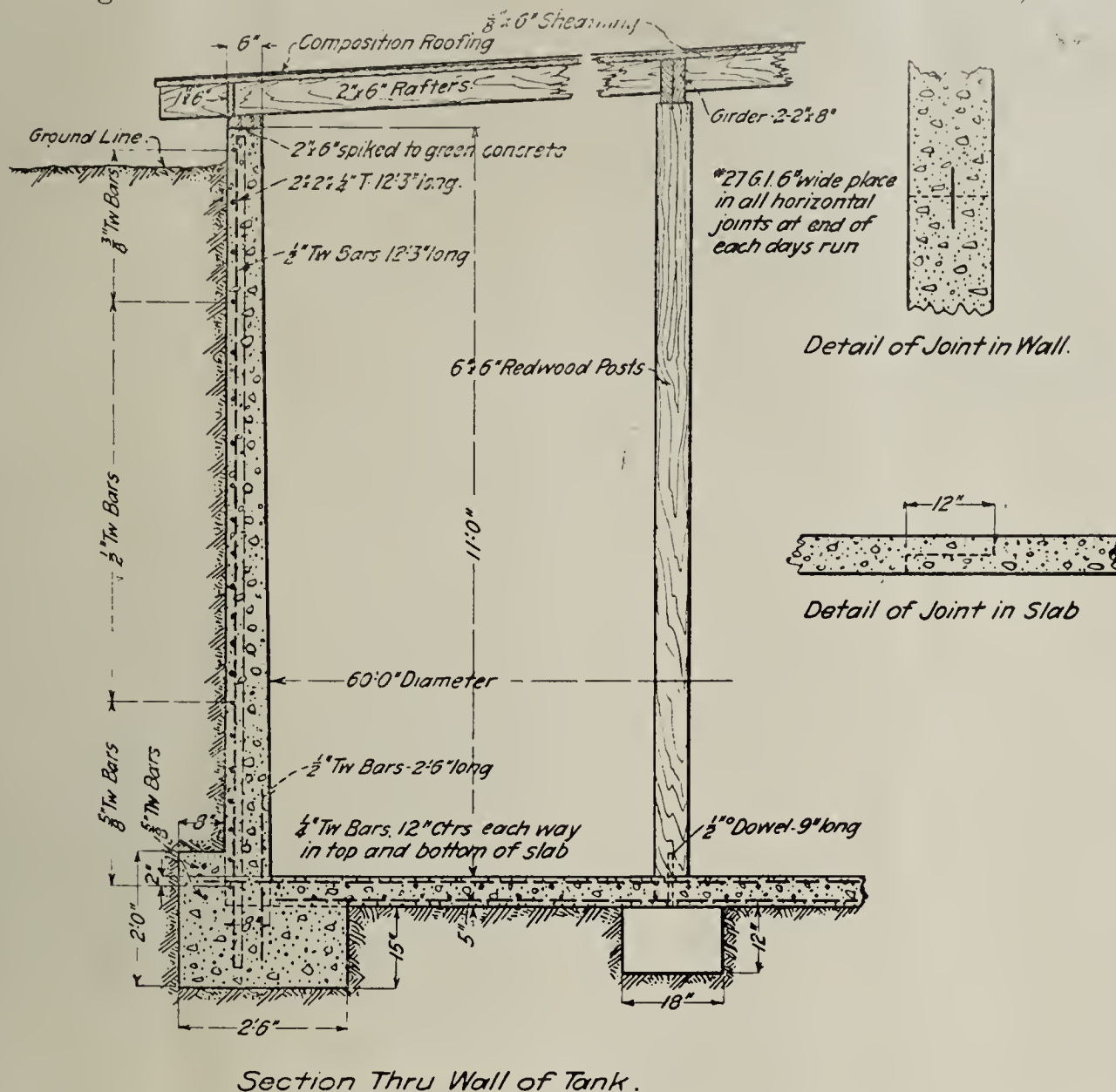
Scrape off the insulation, then scrape the wire itself with the back of a knife, piece of sandpaper, or, failing either of these, a piece of rock will do. Scrape it until it is bright all around and shows the characteristic color of the metal. It is not, of course, necessary or desirable to scrape off the tin from the ends of the electric blasting caps or electric squibs, but it is necessary to get a bright connection, one free from corroded metal, dirt, tar, or grease. With the enameled wire of some electric blasting caps, where it is necessary to shorten the wires, special care must be taken to scrape off the enamel thoroughly, as if any is left on it is likely to cause misfires. The only safe plan is to remove it entirely for about two inches at the end.

In twisting the wires together, it does not matter much whether the two ends point in the same direction or in nearly opposite directions when crossed, but it is of greatest importance that in twisting these

wires together they are held tightly with one hand and twisted as tightly together as possible with the other. After twisting it, work it to and fro to make sure that it is tight; if there is any give to the joint, twist it up until it is absolutely tight, then, as far as that particular joint is concerned, you know that the current will pass with practically no resistance. One of the worst features about loose blasting connections is that they cannot always be detected by means of the galvanometer, for the reason that one moment they may touch and the next moment they may not, and you never can tell whether they are touching or not when it is desired to send the current through the line.

plain and reinforced, to the storage of oil. It has not been a question of cost, for the reinforced concrete reservoir, under normal condition, is more economical than the steel reservoir. It has not been a question of strength, for the reinforced concrete reservoir can be made equally as strong as the steel reservoir. It has been, however, a question of the action of the oil upon the concrete, involving, of course, the question as to whether concrete can be made impervious to oil.

It is a well known fact, that even the heavy grades of crude oil will permeate where water would not, and, of course, the lighter grades of oil and distillate are still worse. The writer, however, knows of one



Section Thru Wall of Tank.

Investigations of complaints of blasting machines, of electric blasting caps and even of the dynamite itself have often proven that the whole trouble was due to faulty connections of the wiring circuit, which could easily be avoided by exercising more care and also by aid of the galvanometer. It is one of those small and seemingly unimportant details where a little care and attention make all the difference between success and failure.—Dupont Magazine.

REINFORCED CONCRETE OIL TANK WATER-PROOFED WITH HYDRATED LIME

By Edward L. Mayberry*

The use of concrete for the storage of water has been in vogue for many years, and with the introduction of reinforced concrete became still more popular from an economical standpoint. Reinforced concrete also permitted the use of circular reservoirs, the reinforcing steel taking care of the tensile stress in the circular shell. It became then only a problem of making the concrete impervious to water; that is, waterproof or water-tight, and this has been done successfully.

There have been many attempts with varying degrees of success of extending the use of concrete,

instance in which the problem has been handled successfully.

The use of 'slop' distillate, as it is called, being a low grade of distillate, for smudging in the citrus belts, naturally brought up the question of the storage of an adequate supply to carry the orchards over a freeze. The West Ontario Citrus Association, at Narod, California, decided to use a reinforced concrete reservoir. This reservoir was built at Narod, California, and is 60 ft. in diameter and 11 ft. deep, giving a capacity of 235,000 gallons.

The accompanying cuts fully illustrate the details of construction. There only remains to describe the method of making the tank oilproof or oil-tight. This was done by adding an amount of hydrated lime equal to 10 per cent of the cement to the concrete when it was being mixed. In addition to this, after the reservoir was completed, the entire inside, including floor and walls, was given a plaster coat from $\frac{3}{8}$ to $\frac{1}{2}$ in. thick, by the cement-gun, this being a process by which a sand and cement mortar is applied by compressed air. The reservoir has been filled with distillate and in use for over six months and there has been no evidence whatever of any seepage.

The reservoir was designed by Mayberry & Parker, architectural engineers, Los Angeles, and was built by L. Fleming, of Pomona.

*Architectural Engineer, Los Angeles, California.

HOW LARGE CITY DEALERS HANDLE BUILDING SUPPLIES

Big city building supply dealers have problems to solve in the handling and delivery of their materials which are seldom understood by the uninitiated. A glimpse at the methods employed by the DeFrain Sand Company, of Philadelphia, Pa., will interest most of our readers.



Loading a motor truck with crushed stone from bins by gravity

The accompanying photographs show a few of the operations by which this company accomplishes results.

Each day seven barges of sand are unloaded by big buckets with a capacity of $1\frac{7}{8}$ yards each, the sand going directly from the barges into the bins, in some cases through a large hopper and again by means of a narrow-gauge, third-rail system, as shown in the photographs. From the bins it is reloaded by gravity into cars or wagons. For loading the cars an ingenious system of pulling them along the siding insures even loading and does away with the necessity for an extra man.

And this is the keynote of the DeFrain Sand Company's organization—efficiency and economy. From the giant dredger, with its capacity of 3,000 tons at



Third-rail car unloading sand into bins

work out on the bar to the three motor trucks and half hundred delivery teams—from the big yard buckets that handle the barges full of big stone that come in every six hours, to the scales that weigh down to the fraction of an ounce—every part of the organization works at maximum efficiency and accuracy.

This is why contractors and small dealers in the city of Philadelphia and the surrounding towns have

come to recognize the DeFrain Sand Company as a sure source of supply, and why in rush seasons they must often increase their delivery equipment by fifty teams.

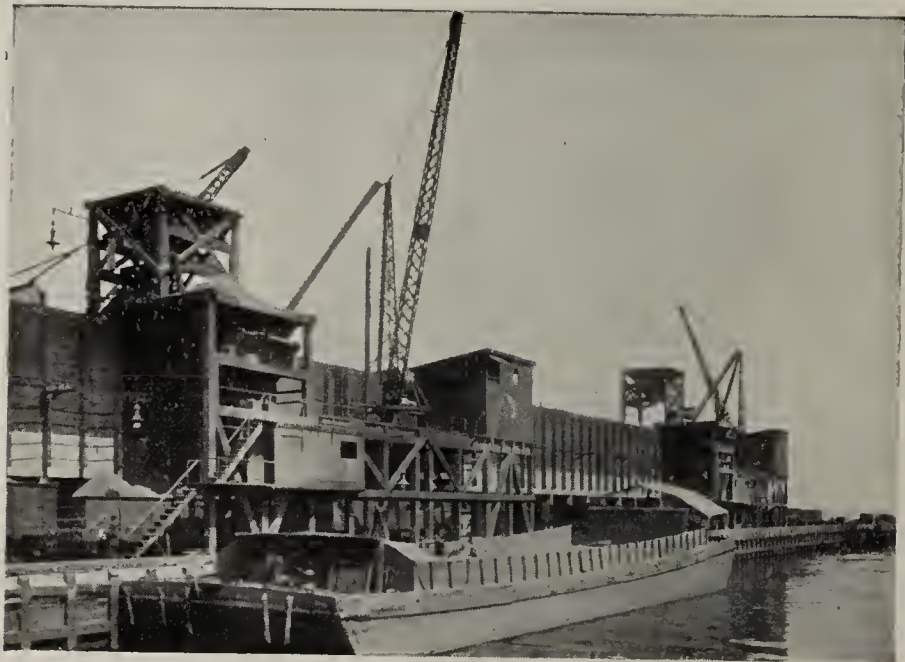
In addition to crushed stone and sand, they also handle about 100,000 barrels of Portland cement each year, some of which, of course, is not yard supply, but furnished direct on contracts. They also handle hydrated lime, plaster, and other building materials.

MEDUSA WATERPROOFING.

Medusa Waterproofing is a dry white powder and consists of fatty acids, chemically combined with lime. Owing to its extreme fineness it may easily be perfectly mixed with cement in the necessary proportions.

Medusa has now been on the market several years, is the original **concrete** waterproofing, patented in 1907, and has been used in every part of the world under every condition and in every character of construction in which Portland cement is used. The dry powder system of waterproofing is far superior to the use of any of the so-called waterproof compounds in liquid or paste form, as these are generally difficult to mix with water, and many of them are practically worthless as waterproofing substances.

As is usual in such cases, the extraordinary success



General view of sand-bins, showing hoppers

of the Medusa Waterproofing has led to a host of imitations and infringements. Medusa is of standard composition, containing 25 per cent of combined fatty acids, while other materials on the market of pretended value contain only 6 to 8 per cent, and therefore must be used in three or four times the quantity to produce the same result. Permanent and thorough waterproofing effect can be secured only by the chemical combination of fatty acids with alkaline earth bases, and this principle is fully covered by Medusa Waterproofing.

Consumers are, of course, unable to determine the composition of the materials furnished for waterproofing, and substances containing only a very small percentage of actual waterproofing may give apparently good results at the start, but experiments have shown that for permanent results a material of the composition of Medusa Waterproofing is necessary.

A trial will convince cement users that Medusa Waterproofing, in dry powdered form, is a true preventive of dampness in concrete. The everlasting quality of its waterproofing effects is due to its being absolutely insoluble and unaffected by water even after years of contact. Medusa is specified by the most eminent architects and engineers in the United States and Europe, and is rapidly displacing the old-time



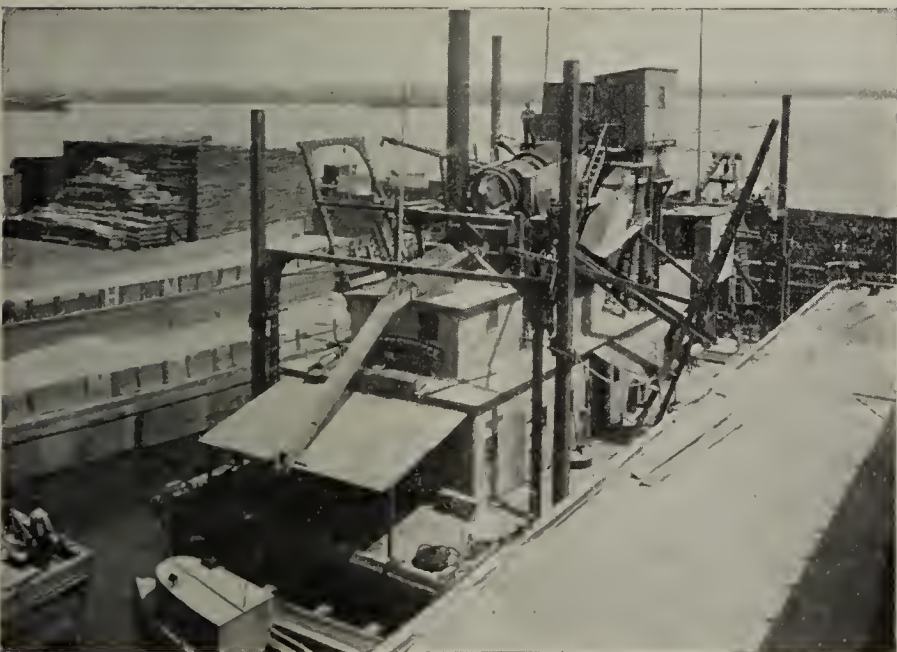
Bucket dumping big stone into hopper

paints and coatings formerly used to prevent the penetration of water into concrete.

To render cement work impervious to water, a small quantity of the waterproofing is thoroughly mixed with the dry cement before the addition of sand and water. For most purposes from 1 to 2 per cent of the weight of cement used will be found sufficient. This is equivalent to from four to eight pounds of Waterproofing to one barrel of cement. The precise amount to be used must be left to the experience of the user, and depends upon the proportion of sand, etc., employed, and on the kind of work to be done.

It is well known that comparatively poor mixtures of cement, sand and gravel or stone are abundantly strong for most purposes. The drawbacks to these poor mixtures is their porosity, which causes them to absorb water like a sponge. So-called water-tight mortar may be made by using a large proportion of cement or cement and lime, at great cost. It has been proven that cement with 1 per cent of Medusa Waterproofing, with five parts sand, gives a more impervious mortar than ordinary untreated cement with two parts sand.

Medusa Waterproofing does not affect the color, strength, setting or hardening qualities of concrete, and when used in proper proportions it will make any concrete work impervious to water and prevent discoloration from rain. It prevents the white efflorescence which so often renders cement work unsightly; also prevents the appearance of hair-cracks on the surface. It will be found to be especially suitable for building blocks, cement plastering, roofing tile, cellar



The dredger for bar sand and gravel

walls, cistern and reservoir linings, conduits, sewer pipe, elevator pits, and in a multitude of other uses in which resistance to percolation of water is required.

The latest catalog of the Sandusky Portland Cement Co. of Sandusky, Ohio, describes in detail, in addition to the many instances known from former publications, a large number of new cases in which Medusa Waterproofing has been used. The booklet contains a great deal of information and is well worth sending for.

HYDRATED LIME IN REINFORCED CONCRETE BRIDGE

The new San Jacinto street reinforced concrete bridge at Houston, Texas, recently completed by the William P. Carmichael Co. of St. Louis, Mo., is 70 feet wide over all and 500 feet long, including approaches. The bridge proper is 322 feet long. San Jacinto street is about four miles above the turning basin of the Houston ship channel which is the head of navigation for large ships. Small tugs and sail boats come up the bayou to wharves a short distance above the San Jacinto street bridge. Buffalo Bayou at this point is 100 feet wide and 10 feet deep.

An earth fill is placed between the floor slab and the roadway pavement. The object of this fill is to allow passage over the bridge of four lines of conduits, two 12-in. water mains and two gas mains. All of these are laid directly on the floor slab. A very good use to which concrete may be put is shown in the construction of conduits, especially for bridges where the space allowable is small. The concrete for the conduits is of 1:5 proportions, the aggregate used being a mixture of sand and fine gravel in the proper proportions. Hydrated lime was used to replace 10% of the cement, thus making a smooth surface and reducing friction in pulling cables through the conduits.

William P. Carmichael Company who built this structure writes: "Hydrated lime was used in concrete for making hand rail on this bridge with three purposes in view: 1. To facilitate easy handling and filling of moulds. 2. To allow moulds to be easily removed from concrete after setting. 3. To give concrete product light color. We are pleased to state that we got the above results satisfactorily from the use of hydrated lime in this concrete, and the general quality of work speaks for itself in the general appearance of the work."

NEW BOOK ON CEMENT TESTING

A new book entitled "A Manual of Cement Testing," by William Allen Richards, B.Sc., and Henry Briggs North, B.Sc., has just been published by the Van Nostrand Company. Price, \$1.50. Sent on receipt of price by Cement and Engineering News, Schiller Building, Chicago.

The object of the authors of this book, as cited in their preface, is to assist in bringing about a uniformity in the testing of cement. The first chapter classifies the cements, describes very briefly their manufacture and composition. Following this, come chapters on sampling, determinations of fineness, specific gravity, and other physical tests which are applied to cement. Part Two gives the method of cement analysis as endorsed and published by the Committee of the American Society of Civil Engineers. The book is of value in that it gathers together under one cover methods of testing which have heretofore only been available in various publications of the American Society of Civil Engineers, The Society for Testing Materials, the Association of the American Portland Cement Manufacturers, etc.

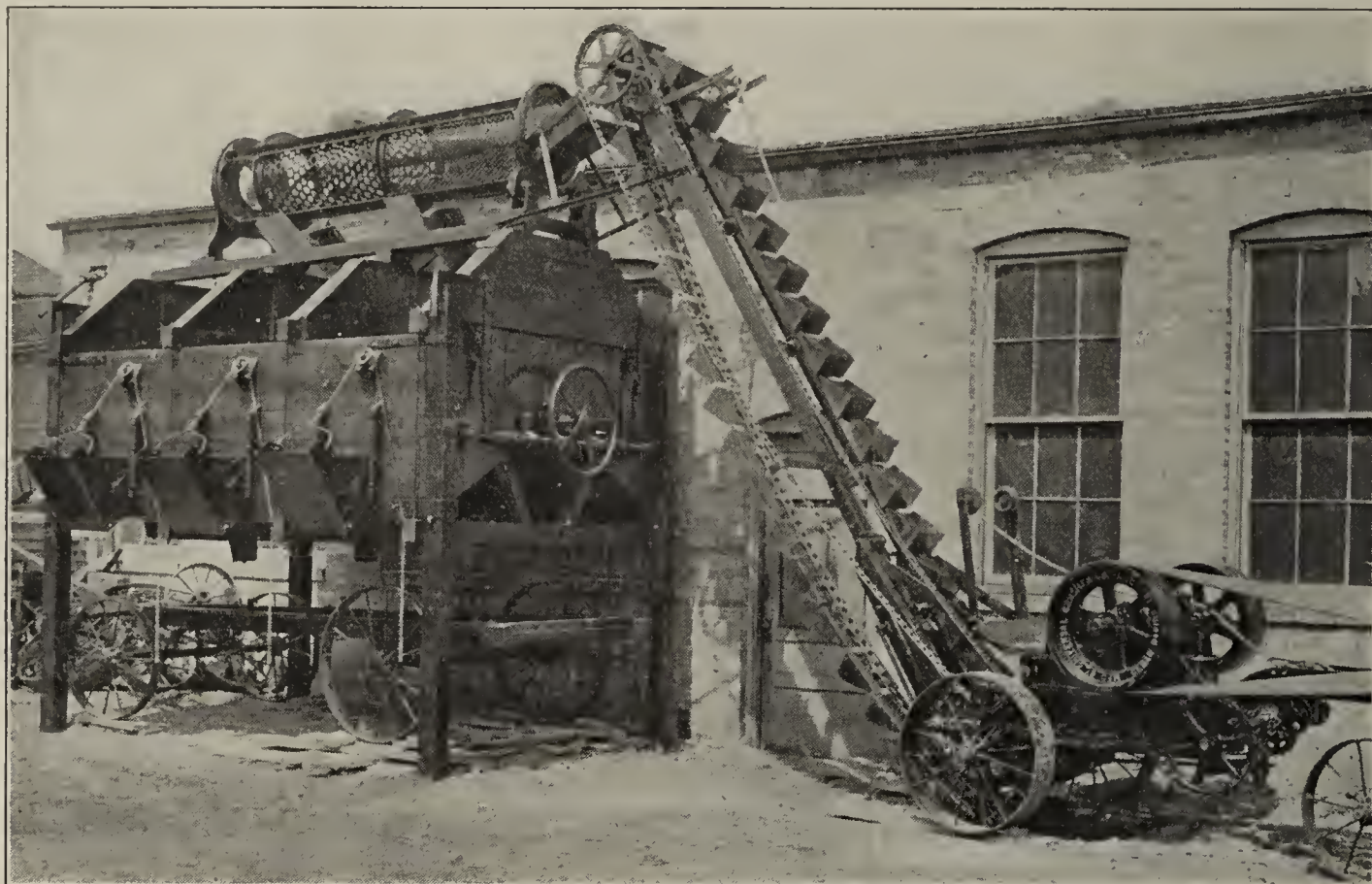
TRAVELING CRUSHING PLANT FOR ROAD WORK

A good roads outfit comprising a portable stone crusher, elevator, screen and bins has recently been placed on the market. The outfit is claimed to be extremely light, thus capable of being easily hauled at small expense over any kind of road. The feeding platform is less than 40 inches high and can be used from either side. The crusher has an opening 8x16 inches and can be operated with 15 horsepower. The capacity when the jaws are set $2\frac{1}{2}$ inches apart is approximately 125 tons per day. The elevator, which comes in 16 and 18-foot sizes, is easily attached and can be folded quickly. The screen is on top of the loading bins, which are also mounted on a truck. The outfit, which is made in four sizes, based according to daily capacity, is manufactured by the Universal Crusher Company, of Cedar Rapids, Iowa.

Co., East Pittsburgh, Pa. The fan differs from the older style in having a large number of blades which are mounted on a wide central disk and have the ends abruptly turned up. The manufacturer claims that this design has been adopted after careful study and many experiments because it is so quiet in operation and so highly efficient. The air is thrown straight forward at high velocity instead of being widely spread out and no air can flow back through the center of the fan, which often happens with the older design.

The unit is very compact and when it is installed, the motor projects but little into the room.

The motor is specially designed for this particular service. It is entirely enclosed and protected from dust, dirt, moisture, etc. It has a high overload capacity and readily drives the fan even against a strong back pressure from wind.



Traveling Crushing Plant for Road Work.

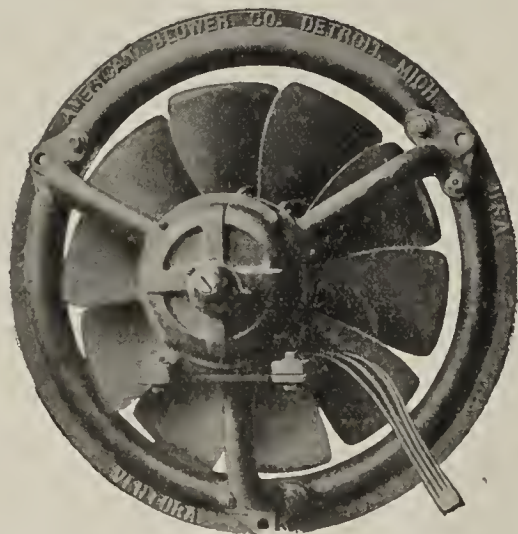
A NEW VENTILATING FAN

Medical science has proved the fact that men cannot work, either mentally or physically, to their full efficiency when subjected to bad atmospheric conditions. Hence many factories and mills, where the air in the working rooms is contaminated with steam, dust, fumes, foul odors, etc., have found that it is a

Special attention has been paid to making the motor thoroughly reliable, since it is ordinarily mounted in places that are difficult of access. It will run for long periods of time without attention and never requires more than an occasional inspection and lubrication.

Owing to the design of the fan and the skillful construction of the motor, the efficiency of these units is very high; that is, they move large volumes of air with minimum current consumption. Power is obtained from the electric light circuit.

For forcing air through pipes, Westinghouse Sirocco blowers are supplied. This little blower can produce considerable pressure and is suitable for forcing air out of underground and inside rooms; cooling motors, blowing away (not exhausting) chips and shavings, etc.



paying investment to install artificial ventilating systems.

A new type of ventilating fan that is said to be especially effective has been recently put on the market by the Westinghouse Electric & Manufacturing

LOCOMOTIVE CRANES

The Link-Belt Company of Chicago and Philadelphia have just received an order from the Navy Department of the United States Government for four steam operated revolving Locomotive Cranes. Three of these cranes will be used at the Philadelphia Navy Yard and the fourth will be used at Charleston, Md.

The Locomotive Cranes are all of their standard eight wheel type, with slight modifications to conform with the Government specifications.

WAGON LOADER

Don't talk hard times. Reduce your costs and earn larger profits, writes the Link Belt Company, Nicetown, Philadelphia, Pa.

One way to do this is by loading your ground storage coal, gravel, cinders, stone, sand, etc., with the efficient Link-Belt Portable Wagon Loader, instead of the expensive hand shovel method.

Hundreds of progressive companies throughout the country are cutting down yard expenses, loading and screening more rapidly than ever before, and are making their business yield greater returns by the use of the reliable Link-Belt Loaders.

Why not start in now, before the winter season begins, and effect economies in your own yard? Don't postpone until the eleventh hour—look into your cost of handling now. Study our Wagon Loader Book and the statements made by coal men, sand, gravel and crushed stone dealers. See what other men in your own line have accomplished with Link-Belt Loaders.

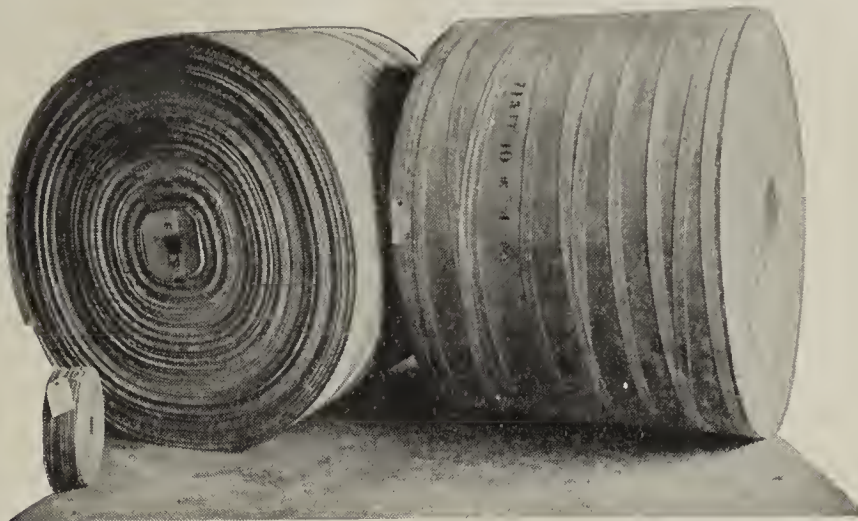
The first cost of a Link-Belt Loader is within the reach of many dealers having even a moderate business. They have certainly proved highly profitable investments for the larger coal, crushed stone, sand and gravel companies, and their use for loading all loose materials is constantly increasing. A loader should easily pay for itself inside of a year.

Wagon Loader Book shows illustrations of all our standard models, and gives specifications, capacities and net prices. The large number of orders received has enabled us to again increase our output and quote lower prices. Write today for Wagon Loader Book containing full information on Link-Belt Loaders, and we will also quote you new reduced prices. Mention Cement and Engineering News when writing.

BIG CROPS CALL FOR BIG BELTS

This year's bumper crops are creating extra effort in the grain handling line, and are causing extra demand for conveyor belting.

The B. F. Goodrich Company of Akron, Ohio, makers of Goodrich Safety Tread Tires, "Longlife" and



"Maxecon" conveyor belts, and everything else in the rubber line, has been filling a great many orders lately, caused by 1914's big crops.

Two immense rolls of "Longlife" belt, each 715 feet long and 40 inches wide, are shown in the photograph, ready to start for the elevator to begin their big job of grain handling.

Stop Shoveling Your Profits Away



Get the Time-Saving, Substantial, Reliable, Economical Van Duzen Mixer, with or without side loader, used by hundreds of large and small contractors. Capacity 50 to 80 yards per day. Both the Price and Cost of Operation will surprise you.

Manufactured under Basic U. S. Letters Patent
Jan. 24-05, Feb. 14-05, Jan. 29-07.

Our catalog fully describes these machines

The Van Duzen-Roys Co.
4th Floor, Hartman Bldg., Columbus, O.

Contractors
Stop! Look! Listen!

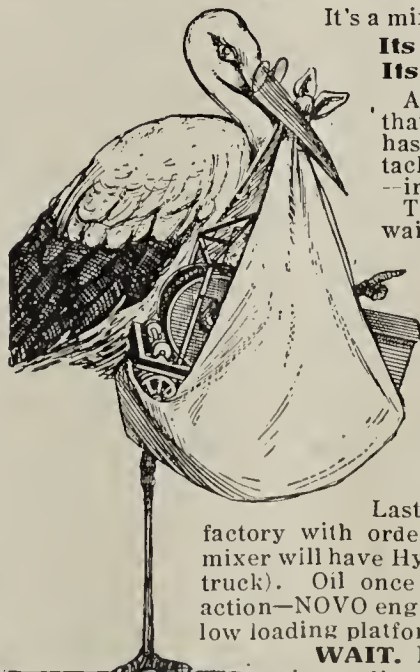
THE GREATEST MIXER SENSATION
IS DUE TO ARRIVE JAN. 1ST

It's a mixer we are proud of—

**Its Father Is Mr. High Quality
Its Mother Is Mrs. Popular Price**

A speedy thorough mixing machine, that does not stop—discharges fast—and has quality features and labor saving attachments not found in any other mixer—irrespective of price.

This is no usual Proud Father Talk—wait and see.



**"LIGHT WEIGHT"
BOSS
STEEL KING**

It More Than Lives Up To Its Name

Last year its low price flooded our big factory with orders. NOW LISTEN—This year, this mixer will have Hyatt Roller Bearings (like a 5-ton Auto truck). Oil once a week—new fast re-mix mixing action—NOVO engines, with 20% excess power—hinged low loading platform—and the price—wait and see.

WAIT. Full page advertisements will appear in leading papers in January—Our literature and low price proposition ready Jan. 1st or sooner—Don't buy a mixer without seeing the BOSS—Write today—We will send complete facts as soon as the printers get literature out.

AMERICAN CEMENT MACHINE CO., Inc.

9635 JOHNSON ST.

KEOKUK, IOWA

HYDRATED LIME

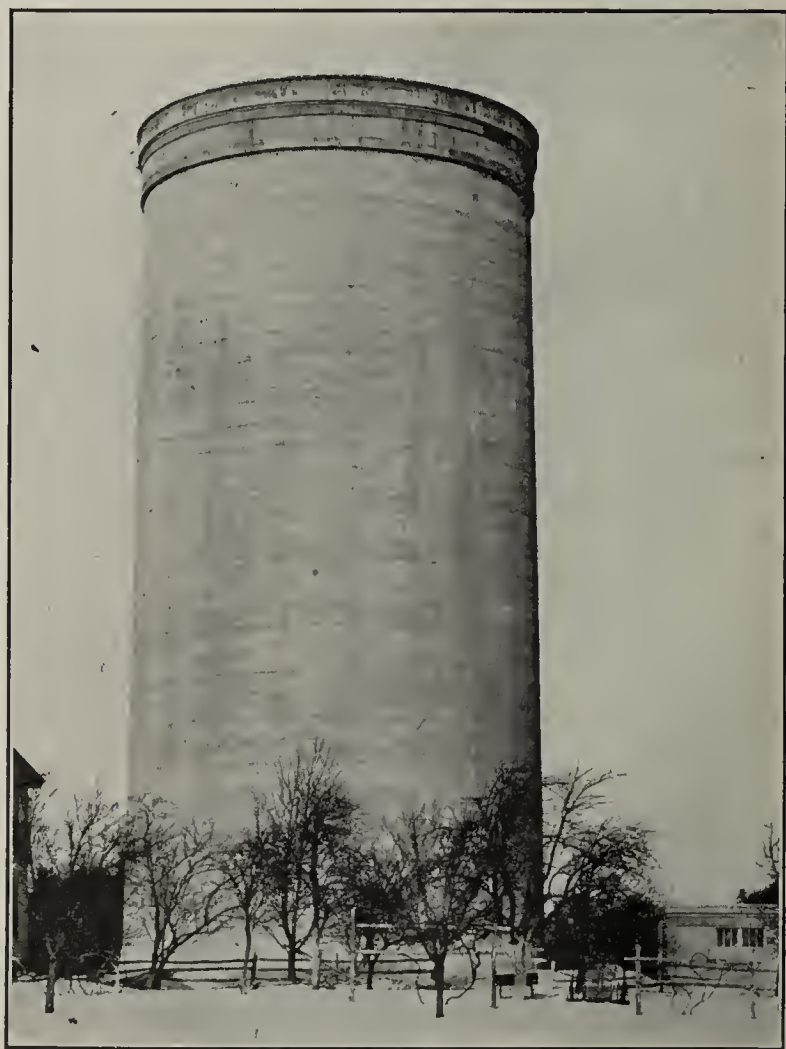
FOR WATERPROOFING CONCRETE

Hydrated Lime is not only the best but also the cheapest water proofing compound known, since it replaces so much cement and the only additional cost is the difference between the price of cement and hydrated lime, which is slight, even at the present low price of cement.

As an actual waterproofer, hydrated lime is not surpassed by any of the waxes and paraffin compounds at the present time used for this purpose. Many of these compounds are organic, and in time will volatilize, leaving the concrete porous. Hydrated lime, on the other hand, is inorganic or mineral, and will remain where it is put.

As an example of the waterproofing properties of hydrated lime, this was employed upon the large concrete reservoir at Rockland, Massachusetts, built by Simpson Bros. Corporation, the well known contractors and engineers, 166 Devonshire Street, Boston, Mass.

See next page for list of lime manufacturers who make hydrated lime and who will gladly furnish you samples, circulars and any information you desire.



Concrete Reservoir at
ROCKLAND, MASSACHUSETTS, ERECTED IN 1910
For the Towns of Rockland and Abington

Dimensions: 46 feet diameter; 104 feet high; capacity, 1,662,000 gallons. Designed and built by Simpson Bros. Corporation, Boston

To make this reservoir watertight, hydrated lime was added equal to 10 per cent. of the cement to the concrete when it was being mixed.

Hydrated Lime on the Panama Canal

Every trowelful of cement mortar used by the United States Government in laying up masonry on buildings on the Panama Canal has been made more plastic, more dense and more water-resistant by the addition of Hydrated Lime. The brick, concrete block and structural tile used in erecting the many important Government buildings in the Canal Zone are all laid in mortar under the following specifications of the War Department:

"MORTAR:—All brick work is to be laid in mortar composed of one part cement and three parts sand, with the addition of 10 pounds of Hydrated Lime to each bag of cement used. The materials are to be thoroughly mixed dry and wet to the proper consistency immediately before using. No retempering will be allowed."

The addition of 10% of Hydrated Lime to the Portland cement used in brick mortar gives to the mortar an extraordinary adhesive quality. United States Government Engineer L. C. Sabin conducted a series of tests which indicated that the Hydrated Lime in the mortar retains the moisture longer than cement alone, thus retarding the setting and enabling the mortar to penetrate deeper into the brick, block or tile and gain a stronger grip.

Hydrated Lime is simply commercial lime scientifically slaked in the process of manufacture. It is shipped to you in 40 lb. paper bags or 100 lb. cloth bags, and there is no fire risk connected with its storage.

Hydrated Lime is used to make concrete, in various forms, more dense, and, therefore, more nearly waterproof. It lightens the color of concrete. It makes cement mortar more adhesive and more plastic, and is, therefore, extensively used in stucco work.

Full detailed information of the methods and cost of using Hydrated Lime may be secured from any of the following competing manufacturers of Hydrated Lime:

Longview Lime Works,
Birmingham, Ala.

Charles Warner Co.,
Wilmington, Del.

Marblehead Lime Co.,
Chicago, Ill.

Ohio & Western Lime Co.,
Huntington, Ind.

Security Cement & Lime Co.,
Hagerstown, Md.

Lee Lime Co.,
Lee, Mass.

Charlevoix Rock Product Co.,
Charlevoix, Mich.

White Marble Lime Co.,
Manistique, Mich.

Glencoe Lime & Cement Co.,
St. Louis, Mo.

Dutchess County Lime Co.,
Dover Plains, N. Y.

Rockland & Rockport Lime Co.,
101 Park Ave., New York, N. Y.

Charles Warner Co.,
103 Park Ave., New York, N. Y.

Kelley Island Lime & Transport Co.,
Cleveland, Ohio.

National Lime & Stone Co.,
Carey, Ohio.

John D. Owens & Son Co.,
Owens, Ohio.

Woodville Lime & Cement Co.,
Toledo, Ohio.

Charles Warner Co.,
Land Title Bldg., Philadelphia, Pa.

National Mortar & Supply Co.,
Pittsburgh, Pa.

Gager Lime & Mfg. Co.,
Chattanooga, Tenn.

Dittlinger Lime Co.,
New Braunfels, Tex.

Round Rock White Lime Co.,
Round Rock, Tex.

Riverton Lime Co.,
Riverton, Va.

International Lime Co.,
Sumas, Wash.

Standard Lime & Stone Co.,
Fond du Lac, Wis.

Union Lime Co.,
Pabst Bldg., Milwaukee, Wis.

HENDRICKS' COMMERCIAL REGISTER

The twenty-third annual edition of Hendricks' Commercial Register of the United States for Buyers and Sellers has just been issued. It is by far the most complete edition of this useful work that has been published. Many new features have been added; thousands of trade names and titles of identification have been inserted and numerous duplications expunged.

"The Assistant Buyer," formerly published by the Sullivan System, has been incorporated with it, and the entire work has been thoroughly revised and improved in every detail.

The aim of this publication is to furnish complete classified lists of manufacturers for the benefit of those who want to buy and sell. It gives the names and addresses of the manufacturers of about every machine, tool and outfit required in the production or preparation of the raw material and the manufacture of cement, concrete, wood, metal, clay, rock, ore, fiber, textile, cereal, chemical and other products into their various shapes and forms for the innumerable uses of man. It also contains complete lists of architects, builders and general contractors (which includes public works contractors, railroad contractors, etc.), reinforced concrete steel constructors and other valuable mailing lists.

The arrangement is such that the book can be used readily for either purchasing or mailing purposes as manufacturers are first classified in particular industries under a general heading for mailing lists, which are also subdivided by firms or corporations under as many classifications as the variety of product calls for.

Considerable information is also given, following the names of firms, that is of assistance to the buyer and saves the time and expense of writing to a number of houses for a particular article.

It numbers some 1,600 pages and contains about 350,000 names and addresses, with upwards of 45,000 business classifications; 138 pages are required to index its contents.

Hendricks' Commercial Register has been in existence nearly a quarter century. It is owned and published solely by S. E. Hendricks Company, Inc., whose address is 2 West Thirteenth street, New York City. It is used extensively throughout the United States and many foreign countries for purchasing purposes by corporations, governments, associations, manufacturers, exporters, purchasing agents and sales managers. Price \$10.00, carriage charges prepaid.

SAND-LIME BRICK

An order for 300,000 sand-lime brick and 160,000 facing brick for use in the construction of the new Miami hotel has been landed by the Crume Brick Company, Dayton, Ohio. The facing brick is known as independent pavers and will be dark red in color.

Perhaps there is no single city in the country where the sand-lime brick has been used in such a diversified number of buildings and to such an extent as in Dayton, Ohio. The Egry Register Company's new building is faced with a rough texture of wire-cut brick; 400,000 sand-lime brick are used in the backing. Pretzinger & Musselman, of Dayton, were the architects.

Wright Bros.' aeroplane factory in Dayton, designed by W. E. Russ, architect, of Indianapolis, is built entirely of sand-lime brick, using about 400,000.

The Hall of Industrial Education is one of the National Cash Register Company's eleemosynary stunts. It contains 450,000 sand-lime brick in the backing, being faced with a grey pressed shale brick. McKim, Mead & White, New York City, were the architects, the contractors being Roche-Brumer Company, of Cincinnati, Ohio.

Dayton is one of the oldest settlements of the pioneer days and is located on the banks of the Miami river, in just about the middle of one of the most fertile agricultural regions of the world. It is nearly on the line of the old National highway, which was in the first half of the nineteenth century designed by the big politicians to reach from Washington City to San Francisco Bay. The road was, in fact, constructed as far as Vandalia, which was at that time the capital of the state of Illinois. Then the highway idea was superseded and the Vandalia railroad, reaching to the east bank of the Mississippi river and paralleling the highway from Columbus, Ohio, to Indianapolis, and thence to St. Louis by way of Vandalia, caused all interest to be lost in the further extension of the highway.

The annual convention of the Sand-Lime Brick Association will be held in the Algonquin Hotel, December 8 and 9, at Dayton, Ohio.

JOHN W. BOARDMAN, JR.

John W. Boardman, Jr., general sales agent of the Peninsular Portland Cement Company, Jackson, Mich., has resigned to accept a new position as the general sales manager of two of the largest Portland cement plants in the entire country with an output approximating 10,000,000 sacks annually, the Huron and Wyandotte Portland cement plants, at Alpena, Detroit and Wyandotte, with general offices in the Ford building, Detroit, and great dock and handling facilities at Duluth, Milwaukee and Cleveland.

By successive steps upward through intensive application Mr. Boardman has prepared himself well for the responsible position he is about to assume, having been afforded exceptional opportunities of experience in all branches of the Portland cement industry from the building of the mill to the marketing of its product.

Just after leaving school in 1903 he went with his father, who at that time was treasurer and general manager of the Southern States Portland Cement Company, of Atlanta, Ga. Commencing at the bottom in the construction period of the affairs of this company he successively graduated through all the different important departments at the plant after it was placed in operation at Rockmart, Ga. This experience gave him an intimate knowledge of how a cement plant was built and operated and also afforded him a great object lesson in the use of great quantities of cement as the plant had largely been built of concrete. This knowledge he was not long in putting into practical use.

Later he entered the office of the cement company at Atlanta and assisted in placing the product of the Southern States plant on the market. In 1906 he went with the Northwestern States Portland Cement Company of Mason City, Iowa, making his headquarters at Minneapolis. He succeeded in placing the product of that company with the most important dealers in the northwest, and laid a foundation for sales in that territory which have since contributed to the success of the Mason City plant.



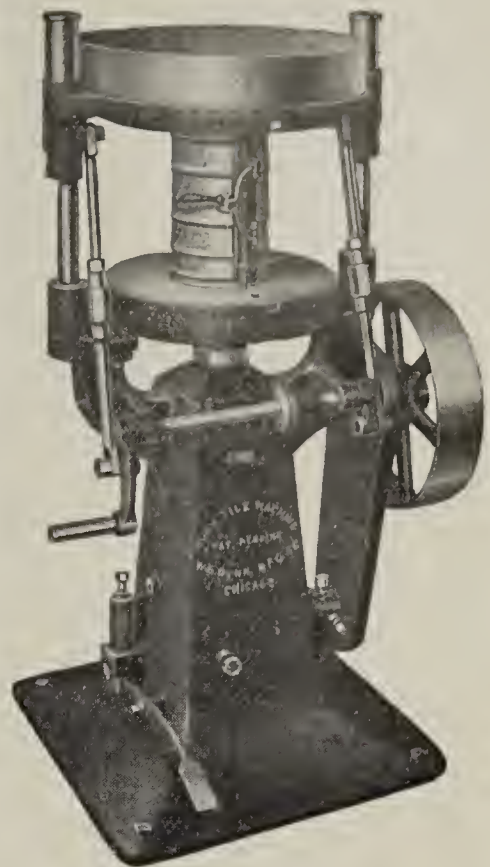
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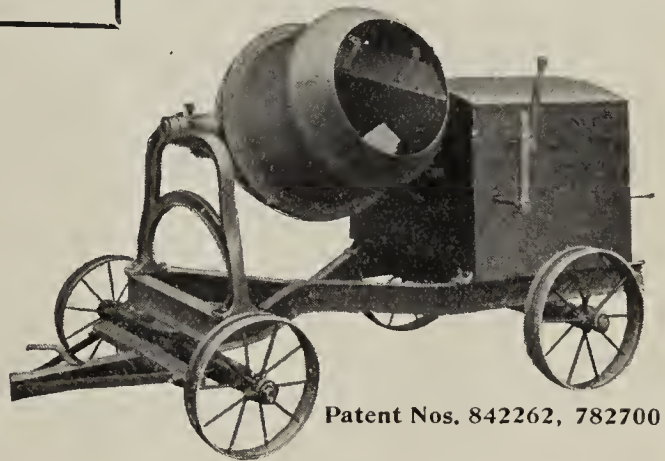
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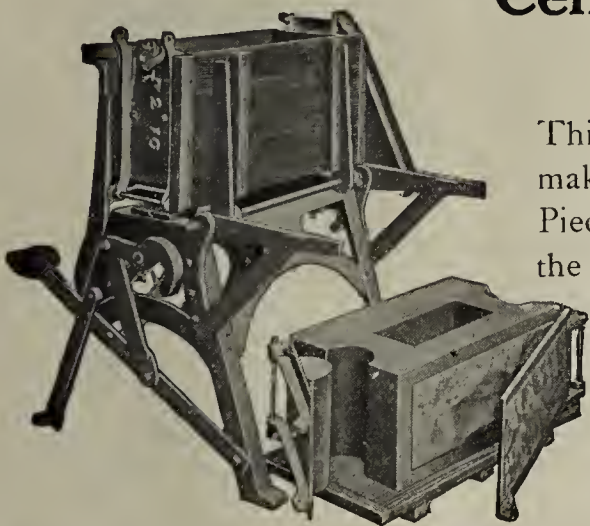
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Why a Dunn Mixer instead of any other? Because the mixing principle assures a better product; because durability and reliability are more pronounced; because they *save labor*.

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—are those made on *Dunn Concrete Fence Post Molds*. We explain how easy they are to make—and to *sell*—in the post mold catalog; write for it. Price of 4-mold battery, \$12.50—on *15 days' trial*.



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AMERICAN ROAD BUILDERS' SHOW

Great interest is being manifested everywhere in the coming annual meeting of the American Road Builders' Association, which will be known as the Fifth American Good Roads Congress and Sixth Good Roads Show and will be held at the International Amphitheatre, Chicago, Illinois, on Monday, Tuesday, Wednesday and Thursday, December 14-17, 1914.

The program, it is understood, is being arranged with especial reference to making it of the greatest interest and the utmost practical value to men actually engaged in road and paving construction as officials, engineers or contractors. The members of the program committee, which is now engaged in the preparation of the program, are as follows: W. A. McLean, chairman, chief engineer of highways and commissioner of the Ontario Public Roads and Highways Commission, Toronto, Ontario, Canada; George W. Tillson, consulting engineer to the president of the Borough of Brooklyn, New York; R. A. Meeker, state highway engineer of New Jersey, Trenton, New Jersey; E. L. Powers, editor of "Good Roads," New York, N. Y.; Major W. W. Crosby, chief engineer of the Maryland Geological Survey, Baltimore, Maryland; William H. Connell, chief of the Bureau of Highways and Street Cleaning, Philadelphia, Pennsylvania; C. A. Kenyon, member of the Indiana Advisory Commission, Indianapolis, Indiana, and A. N. Johnson, Bureau of Municipal Research, New York, N. Y.

The committee in charge of the exhibition—the Sixth Good Roads Show—is preparing some especially unique and interesting features, announcement of which will be made in the near future. The manufacturers of machinery and materials are evincing great interest in the exhibition, as is indicated by the large

amount of space already applied for. The officials of the association are confident that this year's show will far excel anything of the kind ever attempted before. This belief is based upon the most fortunate geographical position of Chicago, which makes it accessible from all points of the country, and the fact that the International Amphitheatre in which the show will be held possesses the best facilities for a show of this kind of any similar building in the United States. Another indication of the success which may be expected is the great enthusiasm with which the matter is being taken up by officials, organizations and private organizations and private citizens in Chicago.

DIXIE CEMENT COMPANY

Reorganization of the Dixie Portland Cement Company, of Chattanooga, Tenn., is reported to have taken place following the acquisition of a controlling interest in the company by Detroiters.

Several changes have been made in the company's officers. Richard Hardy, former Detroit and a graduate of the University of Michigan, who was secretary, has been made president of the company. T. R. Preston, president of the Hamilton National Bank, of Chattanooga, is vice-president.

Among Detroiters interested in the company are Conrad H. Smith, Alexander I. McLeod, Fielding H. Yost and Harry J. Fox. George W. Millen, of Ann Arbor, president of the Beverly Apartment Company, also is a stockholder.

The company's plant at Richards City, Tenn., is said to have capacity for a daily output of about 4,000 barrels of cement.—Detroit Free-Press.

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CEMENT AND ENGINEERING NEWS

Vol. 26

SCHILLER BUILDING, CHICAGO, DECEMBER, 1914

No. 12

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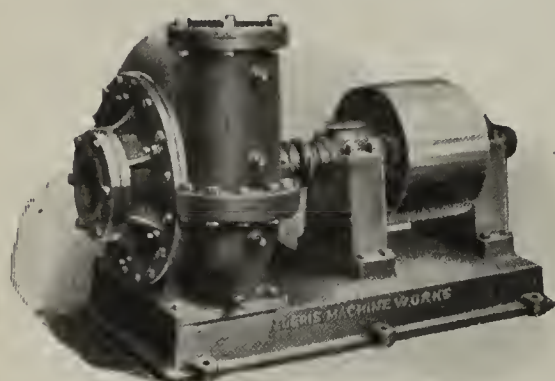


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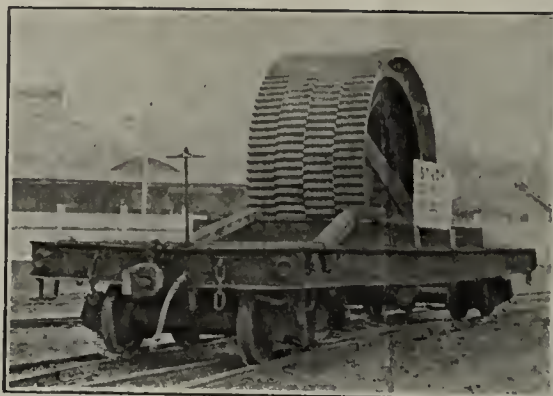
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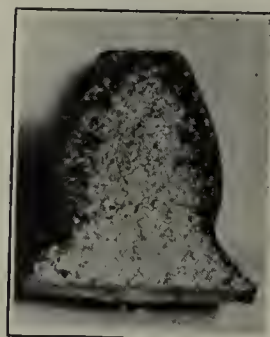
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Limestone, Clinker
or Coal and

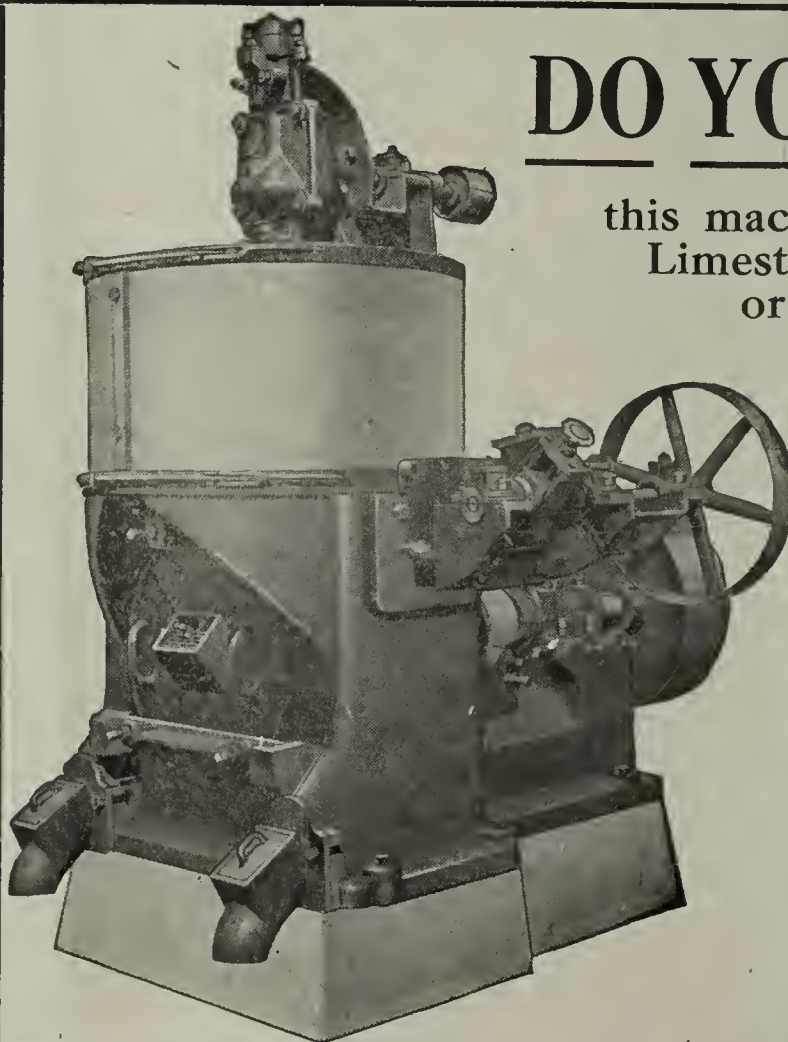
FINISH IT
AT ONE OPERATION?

6-8 Tons Limestone
12-15 Bbls. Cement
PER HOUR

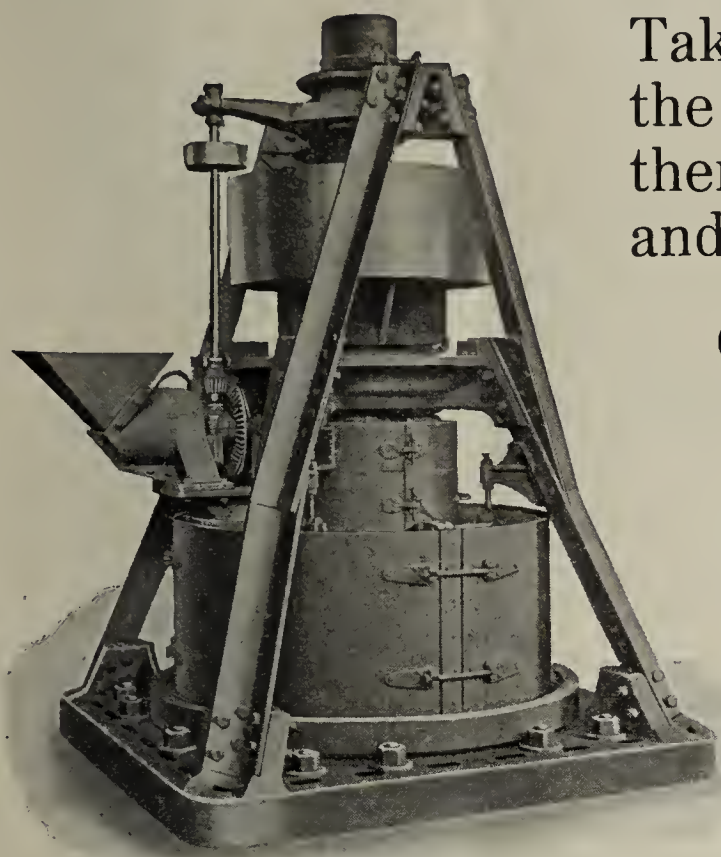
**SIMPLIFIES
EQUIPMENT**

The BONNOT CO.
CANTON, OHIO

909 New York Life Bldg.
KANSAS CITY - - MO.



The Real Satisfactory Clinker Finisher The Giant Griffin Mill



Takes clinker of a size that comes from the kiln; pulverizing in single operation thereby eliminating preliminary grinding and other auxiliaries—

Output from 10-13 barrels per hour.

Horse power 60-70.

Lowest cost for maintenance.

Operated by successful Cement Manufacturers in all parts of the world for pulverizing raw material, coal and clinker.

Bradley Pulverizer Co., Boston

Manufacturers of the Bradley Hercules Mill



SAND-GRAVEL DREDGING PUMPS

are our specialty. We build a full line of Standard Pumps for the most common requirements as well as a complete line for High Heads, either Motor Driven or Engine Driven.

Ask for Bulletin C-30. It Tells You More About Them.

ERIE PUMP AND ENGINE WORKS
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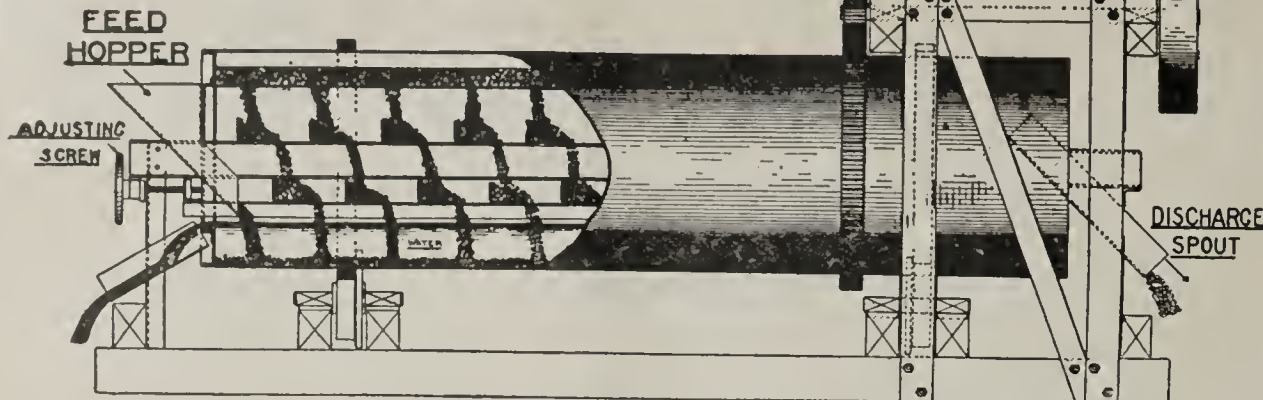


Living Rock!

plastic at your wish—eternally hard at your direction—that is Atlas Portland Cement, valued wherever cement is known as “the standard by which all other makes are measured.”



DULL IMPROVED TUBULAR GRAVEL WASHER



The drawing above gives a general idea of the design of the Dull Improved Tubular Washer. The operative principal is that of tumbling the material about in a bath of water as they progress through the length of the cylinder.

Convert Bank Sand and Gravel into A 1 Concrete Material by Washing It Yourself

A durable washer for contractors' use. Produce your own clean aggregates.

Dull Improved Tubular Washers are built regularly in diameters from 30 to 60 inches with lengths of 8 to 20 feet.

A Special Booklet Sent on Request

THE RAYMOND W. DULL CO.
1912-1914 Conway Bldg., CHICAGO



Pivoted Bucket Elevator-Conveyor for handling Coal, Ashes, Cement, Clinker, etc.

Built for 24 Hours' Service Daily—

Jeffrey Elevators and Conveyors

give the Maximum of Economy and Efficiency in the handling of materials, either in bulk or packed form.

40 Years of Operating Experience, together with the many successful equipments we have installed in Cement Mills, is a guarantee that our *STANDARD* Elevating, Conveying, Screening, Crushing and Pulverizing Machinery equipments will do all we claim.

Write for Our Latest Catalogs and Bulletins

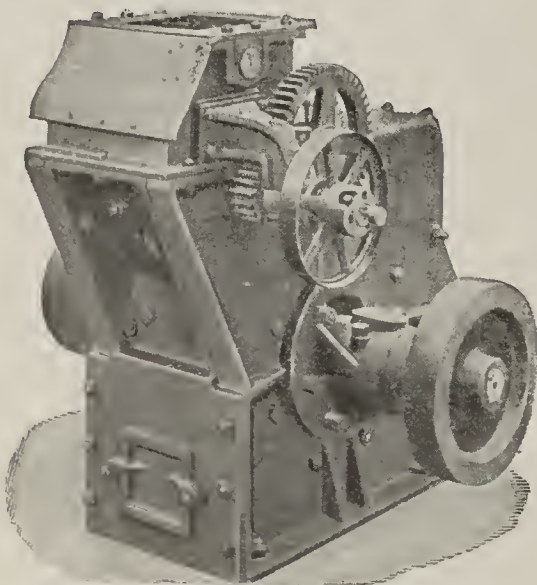
JEFFREY MFG. CO., Columbus, O.



Continuous Double Strand Roller Chain Conveyor handling 700 bags of Lime per hour. 12-1-14

PULVERATORS

FOR PULVERIZING RAW MATERIALS



Any capacity, producing 50% to 65% of product through 200 Mesh Sieve, increasing tube mill output, fineness, and value of your product. Write for Bulletin No. 4028, describing Pulverators — pulverizing by a new principle.

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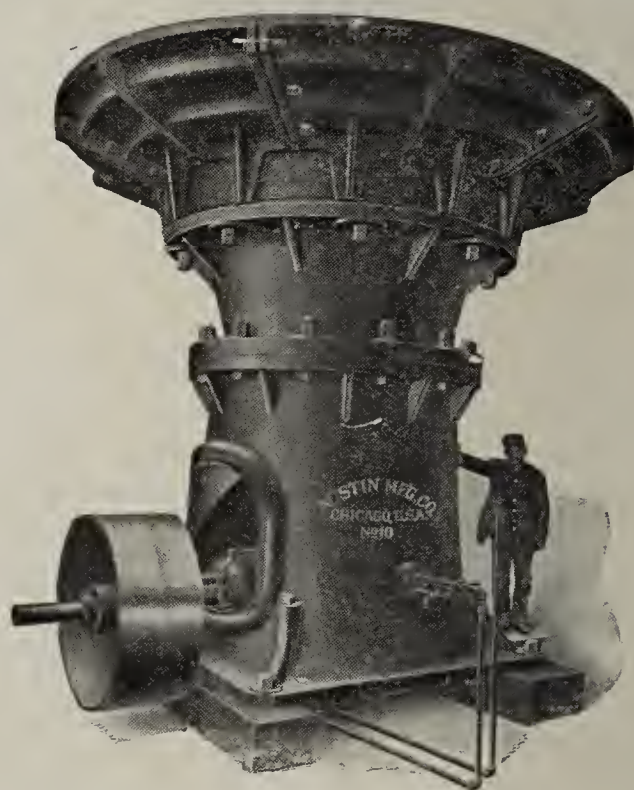
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The World's leading Ore and Rock Crusher. Its many superior qualities and mechanical advantages have won the highest reputation amongst Mining Engineers and Quarrymen.

Made in NINE sizes with capacities from 50 to 5000 tons per day. Smaller sizes can be mounted as Portable Plants. Thousands in use. Plans and specifications furnished for any size of Plant.

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A New Westinghouse Motor

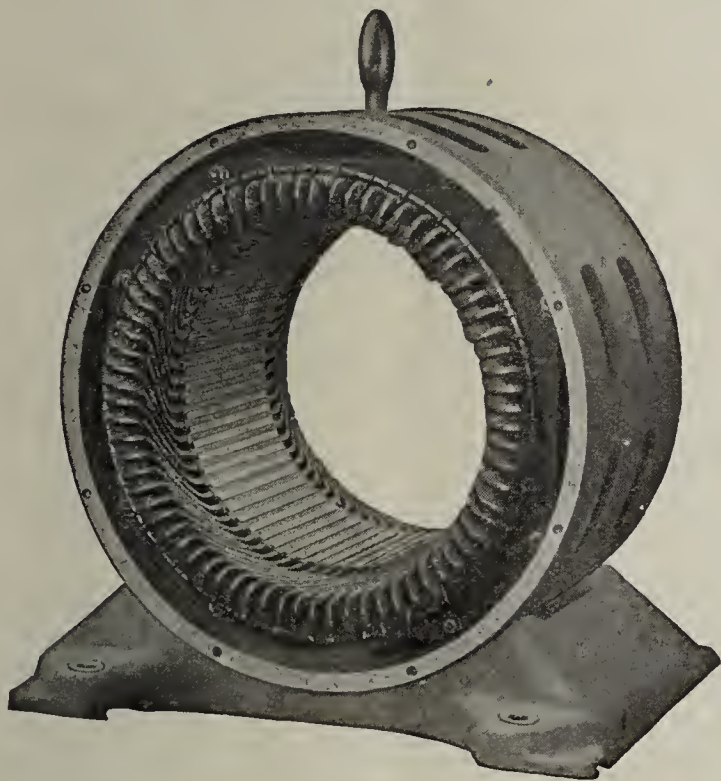
Which We Believe to Be the Best Motor
for Cement Mill Service Ever Built



Motor Complete



Rotor of Motor



Stator of Motor

In developing this motor our aim was to produce one that would give the user the highest degree of successful service.

Before it was placed on the market a series of tests, which lasted over a period of two years, was made. During these tests the motor was subjected to severer conditions than any encountered in cement mill service.

This motor has great mechanical strength, is light in weight because of its pressed steel frame construction, and, in spite of the fact that in normal service it will hardly ever need repairs, it is arranged so that repairs can be easily made.

The use of the open slots and form wound coils for the stator makes rewinding a simple matter. All parts that may need renewal are interchangeable as far as possible and can be quickly replaced.

The shafts are extra large; the bearings have very liberal areas and are thoroughly protected from dust. The rotor is practically indestructible.

All commercial sizes of this motor are carried in stock ready for quick shipment. A request to our nearest office will bring you full information.

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Compactness and Sturdiness Mean Greater Efficiency



The "Excelsior"

was designed and built to set a fast pace for the higher priced mixers and contractors say it does. Equipped with low hopper; friction clutch; dust proof bearings; 3 H. P. engine. Can be equipped with hoist at small additional cost. Capacity $4\frac{1}{2}$ feet mixed material per batch; easily 65 cu. yds. per day. Write for illustrated catalog and judge for yourself the extra value of the EXCELSIOR.

Good territory open for agents

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FOUND AT LAST "HERCULES" SOLID WELD STEAM SHOVEL CHAIN



The Chain that put the SHOVE
in Steam SHOVELS

MADE ONLY BY
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Everything in Cut Gears

We have the largest plant in the West, equipped with the latest improved tools. Quick deliveries, low prices and first-class work our motto.

FOOTE BROS.

Gear & M. Co.
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Spur Gear Reductions made in any horse power and any reduction

Fuller Face Hardened Sprocket and Traction Wheels

Lehigh Car, Wheel & Axle Works, :: Catasauqua, Penn.

Unequaled for severe duty. Proven by test. Their use prolongs the life of chain.

RESULTS:—Increased Efficiency—Saving in Operating Cost.

We manufacture all kinds of wearing parts subjected to abrasion.

Write for Fuller Quality Products Catalog No. 50—C

LIME KILNS

HYDRATED LIME PLANTS

PORTLAND CEMENT PLANTS

RICHARD K. MEADE

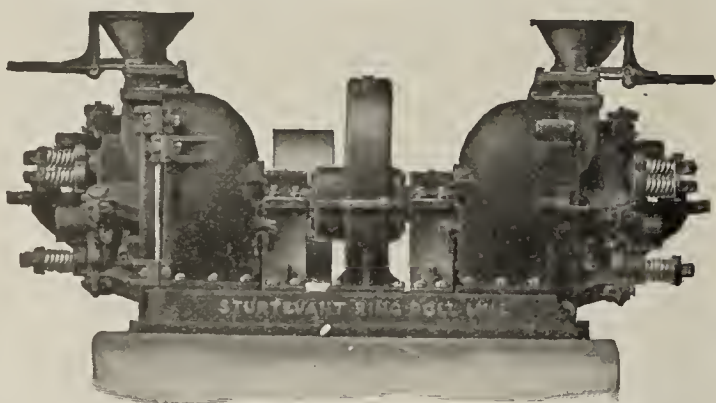
Chemical, Mechanical and Industrial Engineer

202 N. Calvert St., Baltimore, Md.

CEMENT TESTS

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REPORTS ON MINERAL PROPERTIES



STURTEVANT RING-ROLL MILL

For CLINKER, LIMESTONE and COAL
THE LARGEST PRELIMINARY GRINDER BUILT

CAPACITY PER HOUR ON CLINKER

80 TO 120 BBLs.	TO 20 MESH WITH	80 - 90 H. P.
50 " 80 "	" 40 "	" 80 - 90 H. P.
50 " 60 "	" 80 "	" 80 - 90 H. P.

UPKEEP APPROX. 10c. PER BBL.

The Ring-Roll Tube Mill Unit can produce cheaper cement from every standpoint — upkeep capacity, low power and continuous operation than any other. Ask the users, they can prove it to you, and we can.

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Shearer & Mayer Dragline Cableway Excavator

(PATENTED)

A simple, rapid, efficient, economical machine for excavating sand and gravel from wet or dry pits and delivering to screens, bins, cars or storage piles.

It digs, conveys, elevates and dumps in one continuous forward operation. The speed of the dump is under Positive Control of one operator.

It is a substantially constructed piece of equipment with all parts designed to meet the continuous severe service of gravel excavation. The many machines in successful operation testify to the merits of this equipment.

We invite you to investigate this machine thoroughly before installing any equipment.

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Repair Parts For Cement Mill Machinery

Our Specialty

Tube Mill Feeders
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T. M. Revolving Feeders (new style) for Gates Tube Mills
Patterns for all these lines kept on hand.

HULL IRON & STEEL FOUNDRIES (LIMITED)

HULL, QUE.

Manufacturers of "Adamantine"

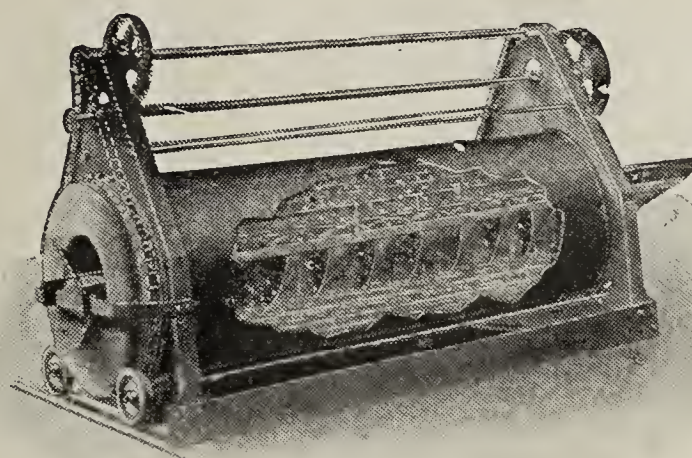
Chrome and Manganese Steel Castings
Machine Moulded Gears up to 16 ft.

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Is Your Material Clean?

If Not, Investigate

THE STOCKER WASHER



*It washes and screens in
one operation*

**STOCKER CONCRETE MATERIAL
WASHER CO., Highland, Illinois**



Heavy Equipment for Heavy Service

Cement Mills must run twenty-four hours every day in the dustiest, dirtiest, hardest conditions in which machinery can be operated.

**Freedom from
Breakdowns and Delays**

means

More Production—More Profits

Most cement mills specify



**Elevating, Conveying and Power
Transmission Machinery**

Catalog K-20

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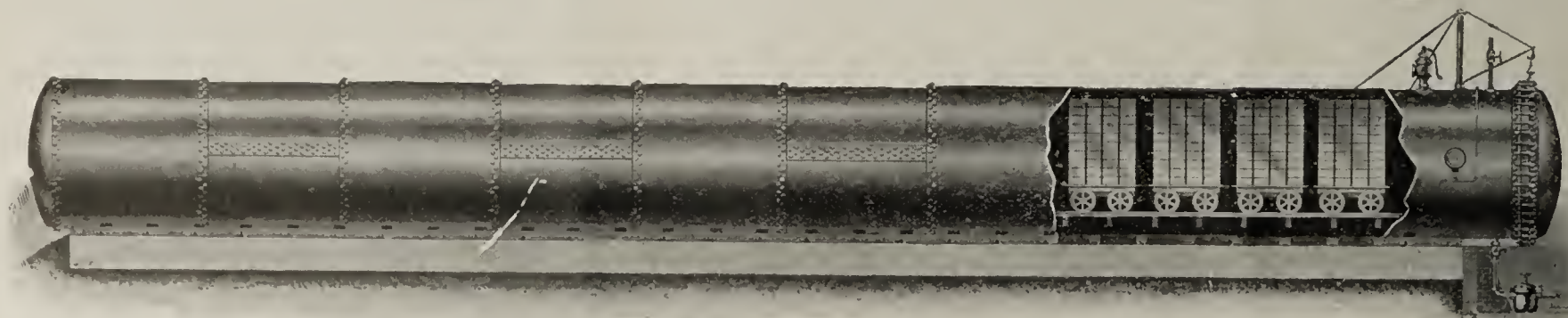
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Sand Lime Brick Machinery

Our complete line of Sand Lime Brick Machinery makes it possible to secure just that machinery which is required to make your plant a success. We favor no particular type of machinery but are guided by the needs of the customer. Our wet and dry grinding mills have transformed a number of unsuccessful plants into dividend producers, while our Presses, Mixers, Hardening Cylinders and other equipment are of equal quality. We can exactly meet the demands of any manufacturer with a quality of machinery which will operate at a profit with a minimum amount of attention and expense.

Correspondence solicited

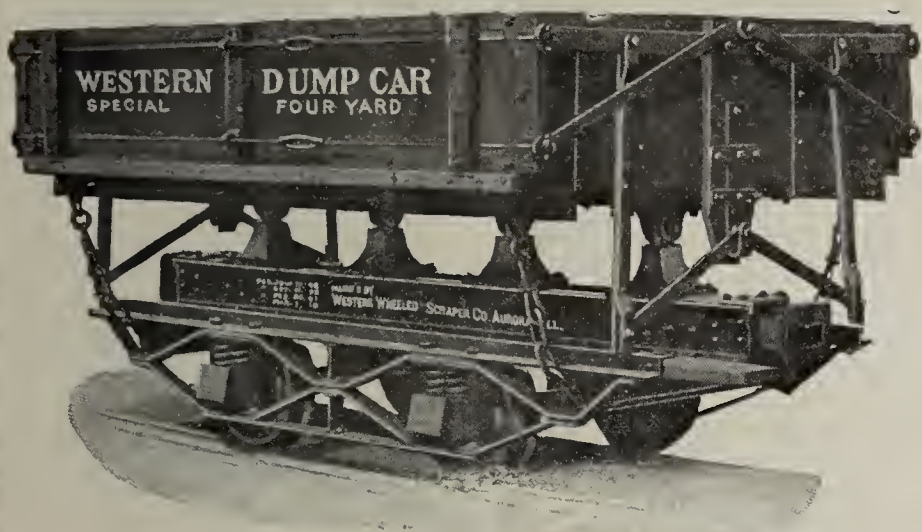
The American Clay Machinery Co.
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MARK**- OBSTITCH -**Reg. U. S.
Pat. OfficeWith Patented Diamond
REINFORCEMENT**"THE BEST TEXTILE BELT IN THE WORLD"**For Cement Mills, Stone Crushers, Pulverizers,
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**FOR HARD WORK**
Western Special Four-Yard Cars

are invaluable when the work requires cars that will stand hard continuous usage. They are of special design. Made of carefully selected and tested material, and reinforced wherever the strain comes. Every quarry man and contractor should have full details about these special 4-yard cars.

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EARTH AND STONE HANDLING MACHINERY
Aurora - - Illinois**CANADA
PEBBLE
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PORT ARTHUR
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This line consists of Globe, Angle and Cross Valves, with or without renewable seats and with inside screw,—the stem threads operating within the bonnet, or with outside screw and yoke; Horizontal, Angle, Vertical or Swing Check Valves; Screw Down Check, Blow-off, Pop Safety and Relief, etc., made in all standard sizes and weights.

The large line of Lunkenheimer High Grade Engineering Specialties comprises, besides the above, a complete line of Bronze Gate and Lever Valves, all of which are likewise furnished with Iron Body Bronze Mounted.

The line also includes "Puddled" Semi-Steel and Cast Steel Valves of all types; Water Columns, Gauges and other Boiler Mountings; Whistles and Ground Key Work of all descriptions; Injectors, Lubricators and Lubricating Devices; Oil Pumps, Oil and Grease Cups; Gas Engine Specialties, etc.

Your local dealer can furnish them; if not, write us.

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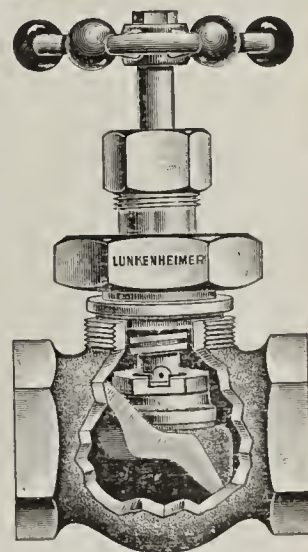
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*Largest Manufacturers of High Grade
Engineering Specialties in the World***CINCINNATI, OHIO**

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Our Model A, shown herewith, is the most practical Hand Power Mixer on the market. Its blend is perfect and will stand the closest inspection. Its capacity depends upon the power at the crank. A man can turn out from 3 to 5 yards per hour. An engine will double this capacity. We can furnish engines also.

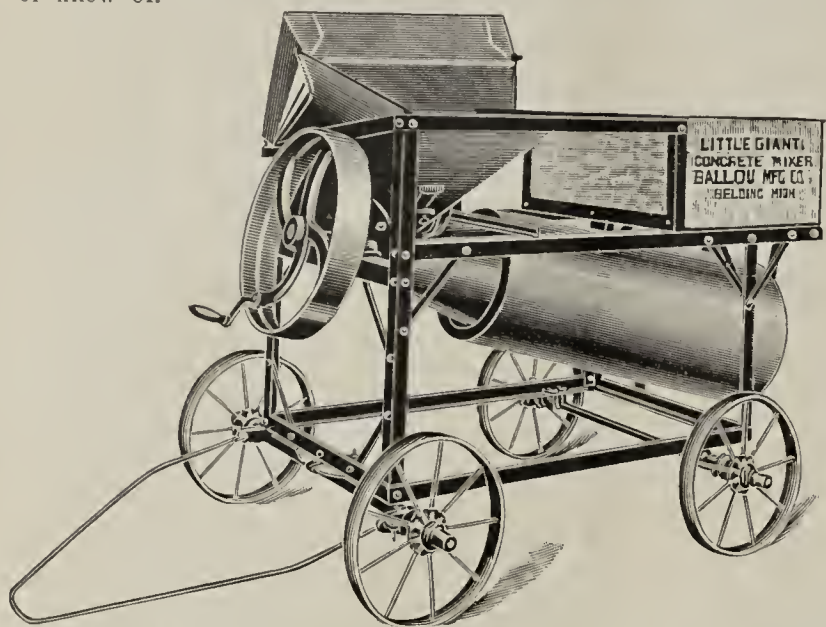
"I have used the Little Giant Hand Power Mixer for two seasons," writes I. J. H. Fender, Coral, Mich. "I have been well satisfied with the ease of operation and the quality and product of the concrete produced."

"With this mixer I put in 260 yards of concrete in two and one-half days on a road bridge in Howard City, Mich."

"I have been using the Little Giant Mixer continuously for all classes of foundation work, and in my block factory for making blocks, bricks and vaults."

"Previous to buying this Little Giant Mixer I bought a batch mixer but discarded it in a short time as it was too slow and practically worthless as a money maker."

"This Little Giant Mixer is a marvel in simplicity, for quality of concrete produced, and the smallness of expense for upkeep, and I would not change it for any other mixer that I have seen or know of."



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Build Culverts Like This

New York State has the best Culverts in the U. S. A. Every worth while thing in the world is built upon a universal plan.

THE ORIGINAL COMPLETE COLLAPSIBLE CULVERT FORM, BUILT OF SPECIAL ROLLED CARBON STEEL PLATE THOROUGHLY GALVANIZED

One complete Form is all any Township needs. This is why they cost less than any Form ever built. Culverts from 12 to 60 inches over the one Form. All parts interchangeable. We are the largest exclusive manu-

facturers of Complete Collapsible Steel Culvert Forms in the world.

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80 per cent. of the Concrete Culverts built by the Town Superintendents of New York State in the past two years, prove this. One Form guaranteed to do the work of six ordinary sheet-iron Culvert Forms.

WE HAVE NO COMPETITORS

—We guarantee our Forms to do exactly what we claim or we don't want your money. Write for large catalog. Good live salesmen wanted in the Central and Western States to learn our selling-plan.

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Protected by forty cost-saving Luten patents. Seventeen suits won, with twenty-two decrees, enjoining thirty-five infringers. Twenty-two suits now pending. Designing engineers are never prosecuted under the Luten patents except when they oppose authorized Luten designs for their own infringing plans.

Herringbone Gears

We are prepared to furnish Herringbone Gears of any size to 30 feet in diameter, five-foot face, any pitch, any material.

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Made in United States

Long Life, Efficient and Satisfactory Service are a few of the advantages of

James Cut Gears

Our facilities are unexcelled. We can furnish gears of any size and of any metal. Rawhide Pinions a Specialty. Write us for prices the next time you are in need of gears. Our proposition will please you.

Catalog giving list of sizes and prices should be on your desk. Write for a copy

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MANUFACTURING
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Manufacturers of
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O.K. Speed
Reducing
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**Make Night Work Light Work
TURN NIGHT INTO DAY**

BY USING

BUCKEYE CARBIDE LIGHTS

From 500 to 10,000 Candle Power
at a cost of less than one cent
for each 1,000 c. p. per hour.

*Thousands in Daily Use
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Write for Catalog No. C. E. 1 today to

THE MACLEOD CO.

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CINCINNATI, OHIO



The Maker of the Modern City

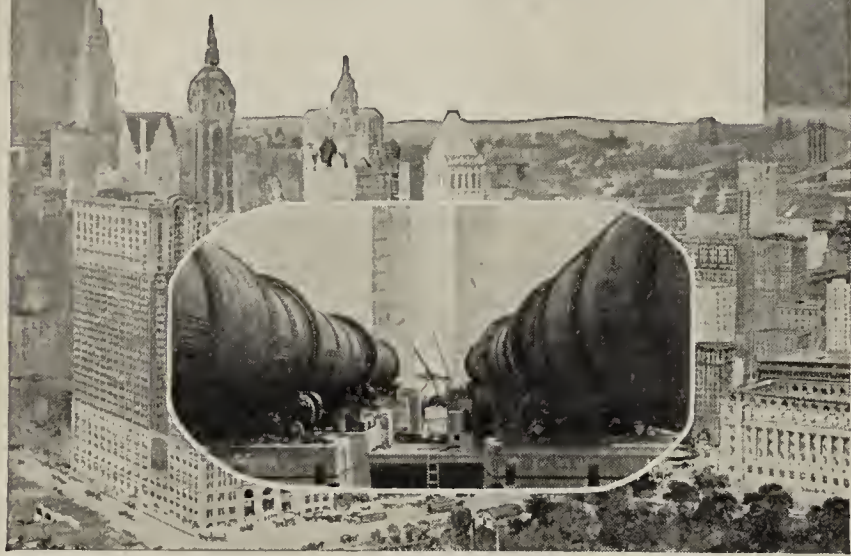
CEMENT wields one of the strongest single influences for municipal well-being. It guards the public health by fostering sanitation; it is a vital part of every building; it paves the streets and roads; it builds the docks and bridges. Modern cities can't grow up without it.

VULCAN KILNS

clinker more cement than any others, for over sixty-five per cent of all kilns are VULCANS, and the biggest makers use them in enormous batteries. For the right way to make that fine, smooth, stronger-with-age cement, ask the biggest American cement makers or

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CALDWELL HELICOID

HELICOID Screw Conveyor is heavier, stronger and better made than any other. Requires fewer repairs—no lapped and riveted joints to come apart—flight all one piece. Special hangers, bearings and boxes for cement work. If you have anything to do with the manufacture of cement, you should write for our No. 38 Catalogue.

Elevating, Conveying and Power Transmitting Machinery.

H. W. CALDWELL & SON CO.

17th Street and Western Ave., CHICAGO

NEW YORK, Fulton Bldg., Hudson Terminal, 50 Church St.

Henry Heil Chemical Company

210 to 214 South Fourth Street, ST. LOUIS, MO.

We make a specialty of
supplying cement works with

Chemical Apparatus, Chemicals and Reagents

Gilmore's Needles, Cement Moulds, Vicat Apparatus,
Schumann's, LeChatelier's and Jackson's
Specific Gravity Apparatus, Etc.

Pyrometers, Calorimeters

High Grade Goods Only

Write for our Large Illustrated Catalogue



LET US SHOW YOU that there is more money in building concrete culverts over our forms, than in any other branch of your business. One form adjusts to any size from 20 inches to 48 inches in diameter, so you need but one investment for all your culvert work. We also make an arch form, adjusting from 6 to 12 feet. One of these forms will insure you all the culvert building in your vicinity at profits that will exceed any other branch of your contracting. Write at once for free catalog and special offer to contractors.

The Merillat Culvert Core Co.

Dept. G.

Winfield, Iowa

Conklin Equipment For Circular Work



Carries its own scaffolding and insures a perfect 6 inch wall.

A smooth wall.

A round wall.

A plumb job.

We eliminate 50 per cent of the construction costs.

Buy an equipment that will build cement chute, continuous doorway and cement water tank on top of silo.

Write for 1915 Catalog

CONKLIN CONSTRUCTION CO.

430 W. Main St. : Hartford, Mich.

"200% Profit in My Second Year"

UP in a little town alongside the Hudson is a live man. Some day he will be a rich man. For, in a little over two years, he has not only created a business of his own, but has doubled his equipment and is planning to triple his territory.

TWO years ago this Summer, he first heard of the Norwalk Vault. Scraping together \$450, he took over the franchise for his County. He kept his regular business position, working at his vault business at nights and odd times.

WITHIN a year his profits had paid back his original investment, and left him a hundred dollars or so to the good besides. In his second year he cleared more than 200% profit.

ALL this was done, mind you, outside his regular working hours, and, in a dark, low cellar. He had no one to help him, and no capital. Now, however, things are about to change; he is moving into a shop with plenty of light and air and plans soon to resign his position and devote all his time to developing his own business. In another two years, at his present rate, he will be independent with money in the bank.

(Not that we recommend any man to start a vault business in his cellar without capital or equipment. The odds against success under these conditions are so great that it takes a better than average man to win out. But it can be done, and if by any chance you happen to be the kind of man that will make good if given half a chance, we would be glad to talk it over with you.)

THE man we would rather hear from, is the one a little surer of success—the man with enough capital to go into vault manufacturing for his locality in a way big enough to make it a pleasure rather than a struggle. With the Norwalk Vault it is just as easy—and a good deal more certain—to make 200% on an investment of \$4,500 as on one of \$450.

THE amount of money required varies directly with the size of the territory occupied. Even in the large cities, though, the capi-

tal necessary is astonishingly small compared with the possible returns. You won't need an expensive factory—any respectable shed will do; not high priced labor—any intelligent laborers can do the manufacturing; nor any large sum tied up in machinery or materials—a few dollars at a time will keep the work going.

THE cement burial vault business is in its infancy. Not one man in ten now knows that in the Norwalk Vault he may provide for a departed wife or brother an absolutely airtight and moistureproof protection that literally "Lasts through the Ages." But the idea is spreading fast, and sooner or later this method of sanitary and permanent burial will in your town, as elsewhere, put to shame the old fashioned damp and muddy cistern of a grave.

EVERY day, therefore, the franchise to manufacture the Norwalk Vault in any territory becomes increasingly valuable. Nearly half of the United States has in the last six years already been taken over by local manufacturers. If your territory has not, we will invite you to compare the opportunities of the Norwalk Vault with any other business you can find.

LOOK through the advertisements in this or any other magazine; see if you can discover any other article, patented and trademarked, with a sale based on as unchanging a thing as the human death rate, that you can develop exclusively in a protected territory, and cash in on as fast as the article becomes known to the public.

IF the idea appeals to you—and you have the energy and capital adequately to take care of your territory—write us for the details. We'll be glad to answer fully and frankly every question in your list, no matter how long. No obligation whatever on your part. Address

The Norwalk Vault Company

38 Seminary Avenue

NORWALK, OHIO

WHACK!

The POLK-GENUNG-POLK COMPANY

has formally declared war on the high cost of circular monolithic concrete construction. The first big broadside was fired on November 23, 1914, when, after a meeting of the Directors, it was announced that the

POLK SYSTEM MACHINES

would be sold at greatly reduced prices. In order to secure the benefit of these special prices it is necessary that the order be booked prior to February 17, 1915, the closing date of the Chicago Cement Show. Details of this special sale plan will be gladly furnished on request.

Polk-Genung-Polk Co., Fort Branch, Indiana

DEXTER Portland Cement
THE NEW STANDARD

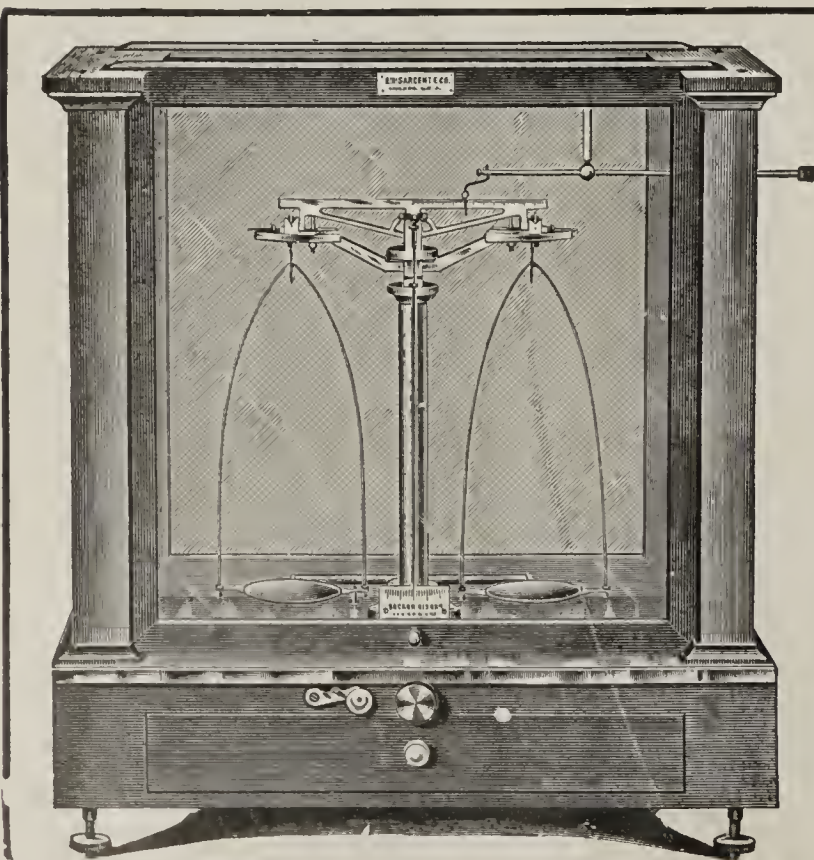
Sole Agents **SAMUEL H. FRENCH & CO.** Philadelphia

DANIEL B. LUTEN
INDIANAPOLIS

Designing and Consulting Engineer

Reinforced Concrete Bridges Exclusively

Associate Engineers in each State



E. H. SARGENT & CO.

(Established 1852)

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CHEMISTS SUPPLIES

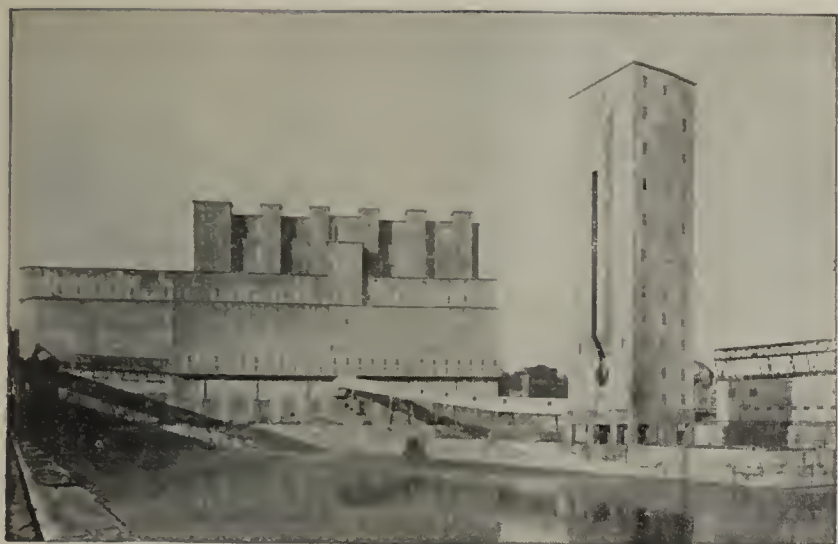
Of high grade only.

We call particular attention to our Cement Mould, Vicat Indenting Apparatus, as improved by us, Gilmore's Needles, Jackson's specific gravity apparatus, etc.

We send catalogue without charge to responsible parties.

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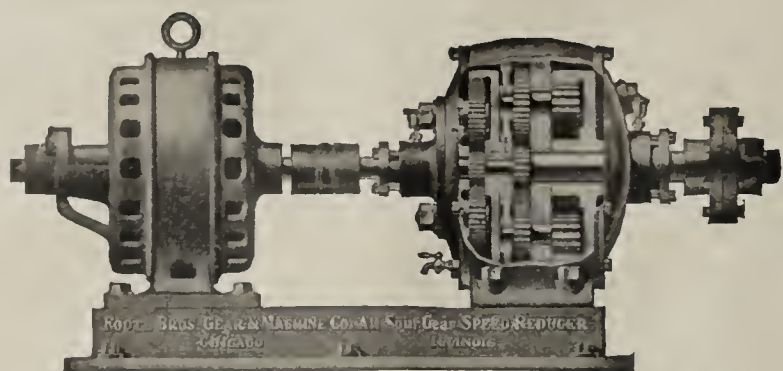
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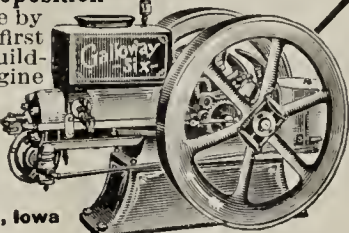
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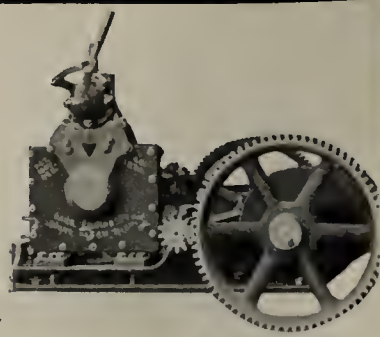


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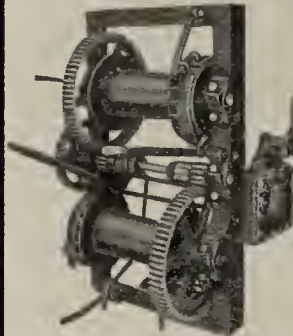
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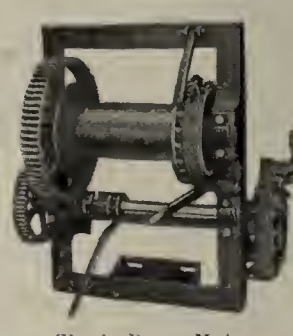
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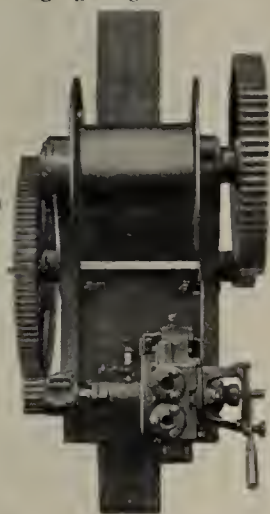
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Double Drum Motor Crab



Single Drum Motor Crab



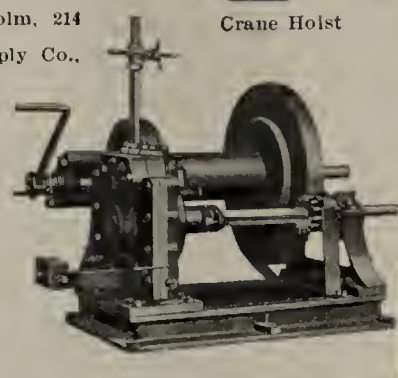
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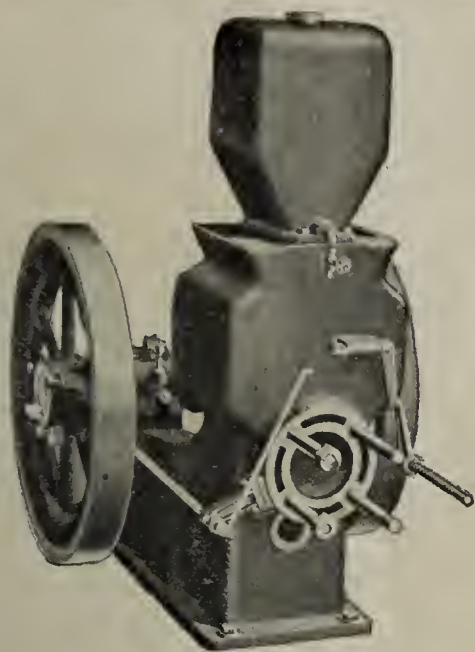
Difficult waterproofing problems in NEW or OLD work can be economically and successfully solved. The experience of a successful organization is at your service and satisfactory results are guaranteed.

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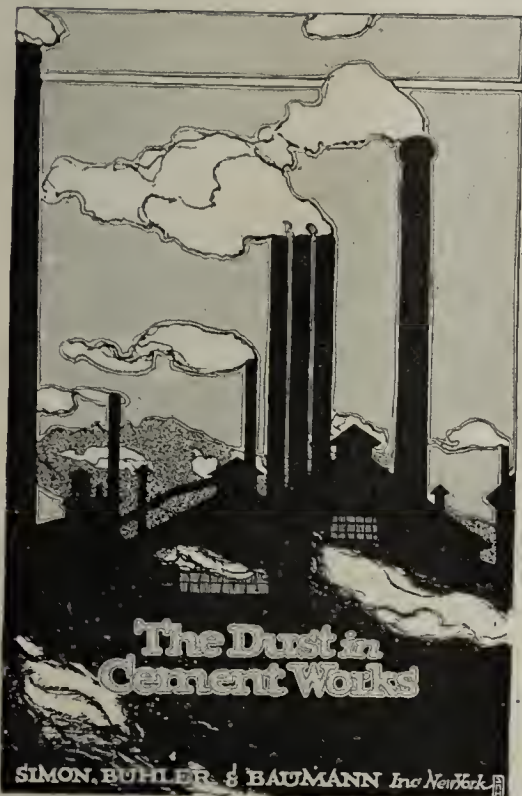
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Why It Should and How It Can Be
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Known as "The Drill That Drills"

Driven by Steam, Compressed Air, Gasoline or Electric Power; is made in many sizes and types and is thoroughly up-to-date.

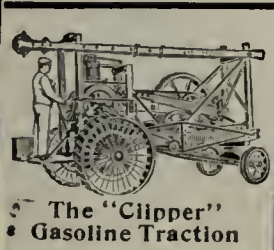
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It is a Blast Hole Drill for all conditions—soft rock and hard rock—shallow holes and deep holes; in fact, with a "CLIPPER" Machine you are safe!

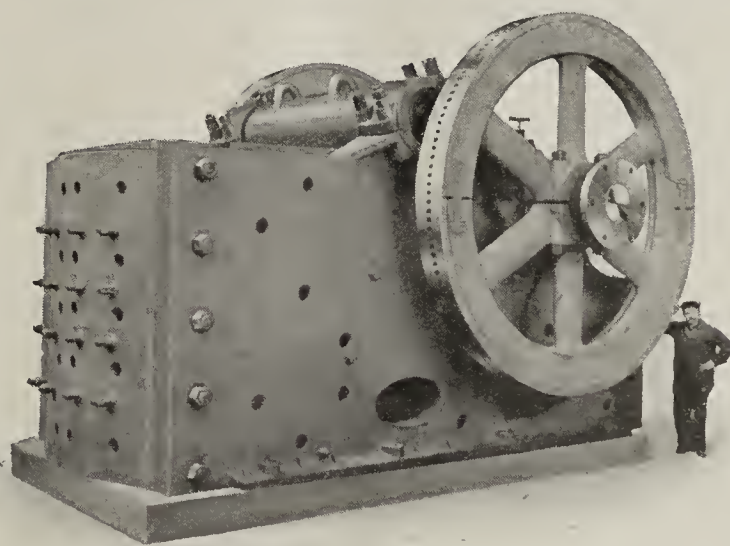


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NEW BOOKS

Rock Drilling. By R. T. Dana and W. L. Saunders. Pp. 319; ill., index. For sale by the Cement & Engineering News, 1117 Schiller Bldg., Chicago. Price \$4.

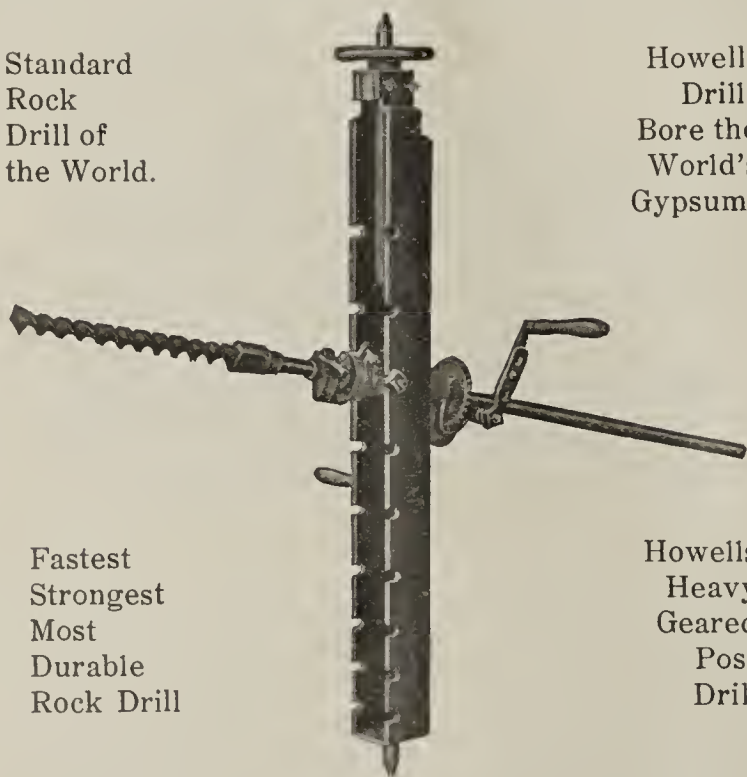
Following a general introductory statement covering blasting and explosives, this volume treats in detail the methods and costs of open-cut excavation and submarine rock-drilling. It is based principally on material collected and compiled by engineers of the Construction Service Co., and includes accurate records of cost and drill duty in many kinds of work. Diagrams and tables are freely used in such shape as to make more than a mere record of cost. Accurate comparisons and analyses become easy. The book is well written and well illustrated and is sure to prove of large value to consulting and constructing engineers.

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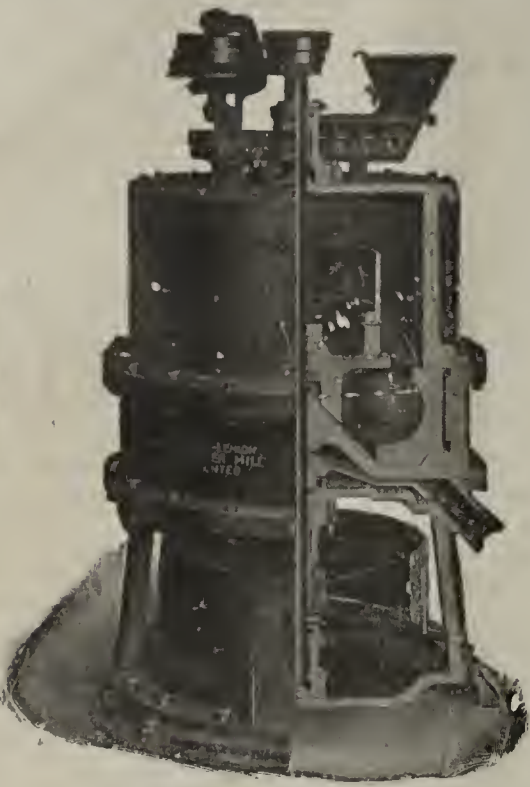
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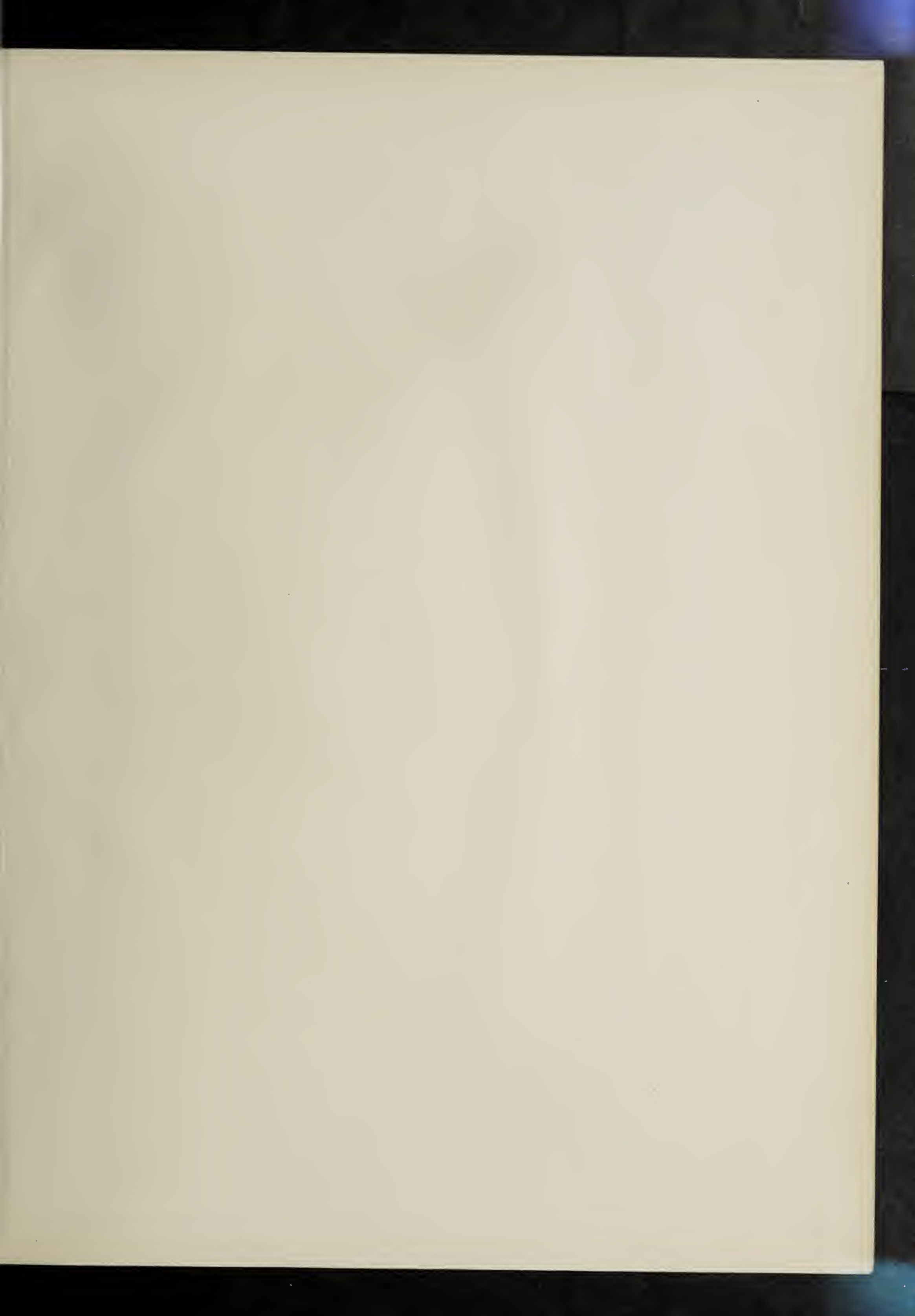
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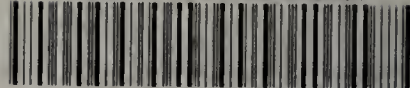
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